

***United States Court of Appeals
for the
District of Columbia Circuit***



**TRANSCRIPT OF
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United States Court of Appeals
for the District of Columbia Circuit

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JOINT APPENDIX

Nathan J. Paulson
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Appeal No. 19,105

United States Court of Appeals
for the
District of Columbia Circuit

Civil Action No. 153-63

VINCENT W. ECKEL,

vs.

DAVID L. LADD, Commissioner of Patents,

Appellant

Appellee.

Appeal From Judgment of United States District Court for
The District of Columbia.

985

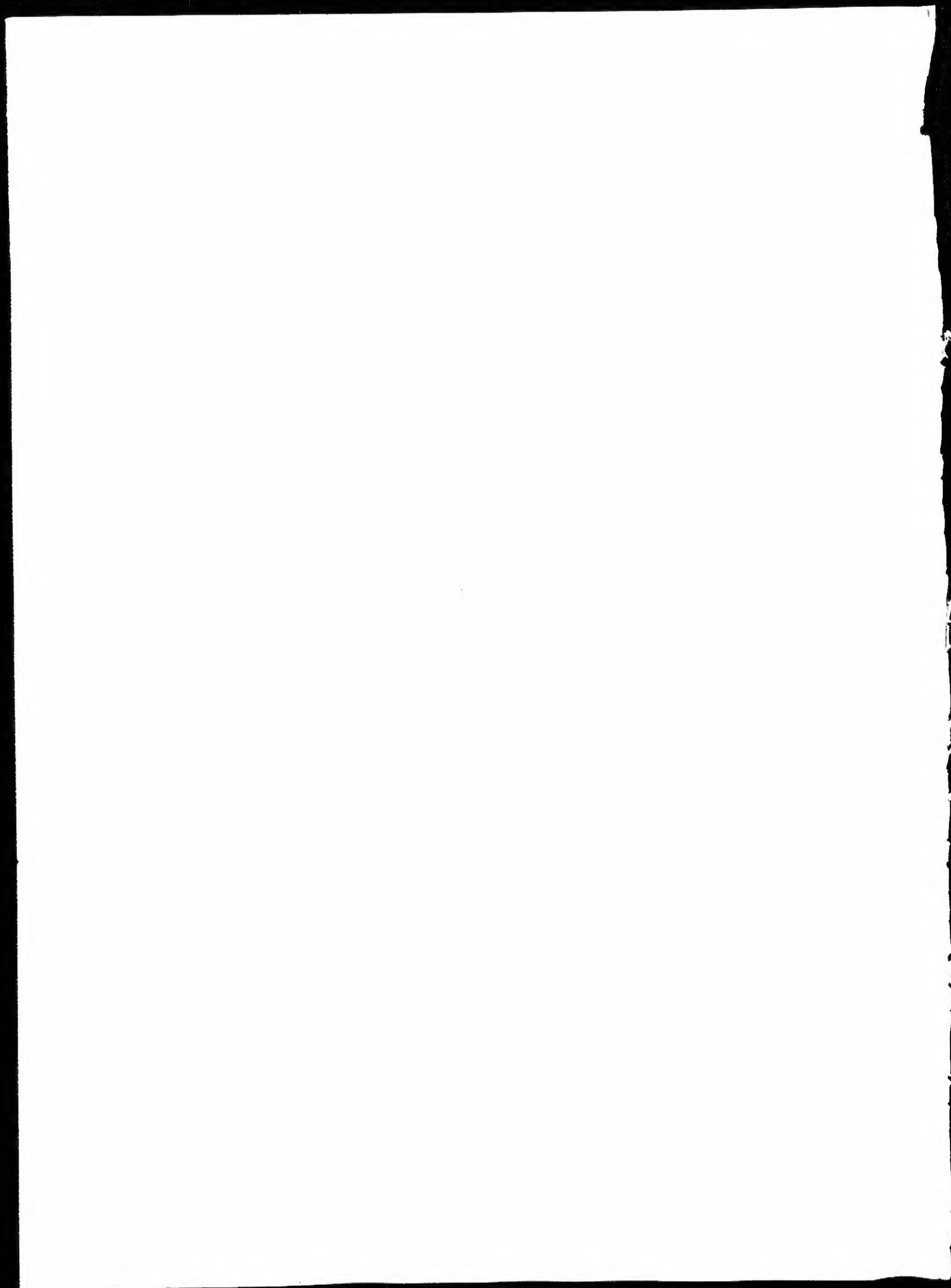


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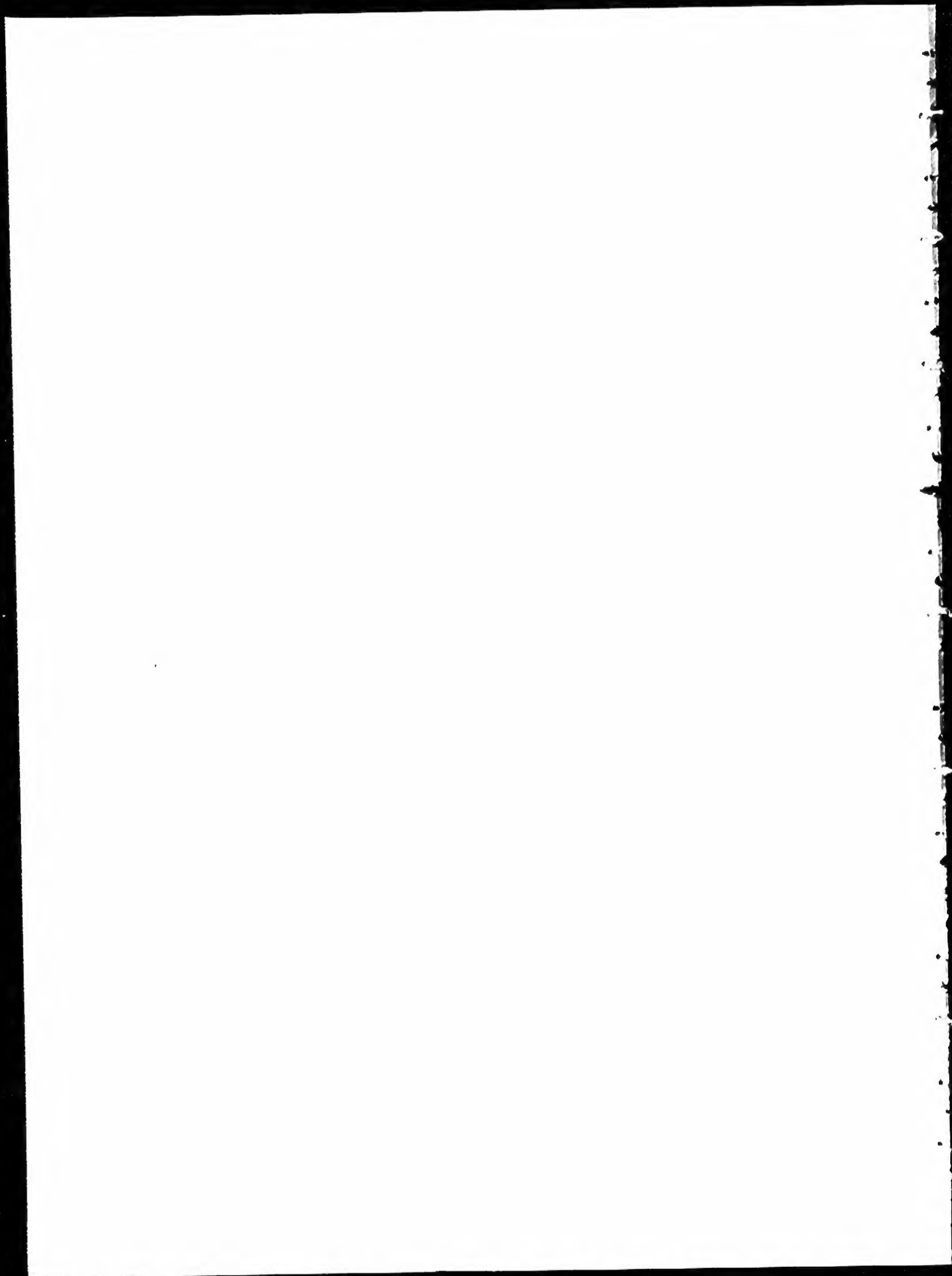
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United States Court of Appeals
for the
District of Columbia Circuit

Civil Action
No. 153-63

VINCENT W. ECKEL
See Canyon
Route 1, Box 65G
San Luis Obispo, California,

Plaintiff,

vs.

DAVID L. LADD
Commissioner of Patents
Washington, 25, D. C.

Defendant.

Complaint for the Issuance of Letters Patent.

To the Honorable, The Judges of the United States
District Court for the District of Columbia:

1. Plaintiff Vincent W. Eckel is a citizen of the United States and resides at See Canyon, Route 1, Box 65G, San Luis Obispo, California.

2. Defendant is the Commissioner of Patents of the United States, and has his official residence in the District of Columbia. Defendant is sued in his official capacity.

3. This action is brought under the provisions of the Act of July 19, 1952, Public Law 593, 82nd Congress, 2nd Session, Title 35 U.S.C., Section 145.

4. Prior to January 18, 1952, plaintiff Vincent W. Eckel invented certain new and useful improvements in a solenoid operated actuator and valve, for which invention he duly filed in the United States Patent Office an application for patent. Said application was filed on January 18, 1952 and was given Serial No. 267,178, and said application was refiled as a continuation-in-part application on May 27, 1957 and was accorded Serial No. 661,837. Each of said applications 267,178 and 661,837 were duly prosecuted in accordance with the requirements of law and the rules of the Patent Office.

5. Said application Serial No. 661,837 was examined by the Primary Examiner in the Patent Office and claims 1-8, 10, and 12-16 thereof were rejected as unpatentable over Hammond U. S. Patent No. 2,420,241 or Fuscaldo U. S. Patent No. 2,297,399 in view of any one of Heinrich German Patent No. 662,027, Gachon French Patent No. 876,454 or Bosch Swiss Patent No. 93,102; claims 1-16 were rejected as unpatentable over Gachon French Patent No. 876,454.

6. From the rejection of each of said claims 1-16 plaintiff duly appealed to the Board of Appeals of the United States Patent Office on or about August 11, 1960, in accordance with requirements of law and the rules of the Patent Office and said appeal was accorded Appeal No. 38,512.

7. In an Examiner's Answer mailed on or about January 4, 1961, the Primary Examiner again errone-

ously rejected claims 1-16 as being unpatentable over the Gachon French Patent No. 876,454 and while the Primary Examiner admitted that the device shown in said Gachon French Patent No. 876,454 is schematic insofar as the assembly is concerned, the Primary Examiner erroneously concluded that a person of ordinary skill could assemble the Gachon device in a conventional manner such as suggested by Hammond U. S. Patent No. 2,420,241 or Heinrich German Patent No. 662,027 and in so doing would create plaintiff's claimed invention; also, the Primary Examiner rejected claims 1-8, 10, and 12-16 as being unpatentable over Hammond U. S. Patent No. 2,420,241 in view of Heinrich German Patent No. 662,027, Gachon French Patent No. 876,454 or Bosch Swiss Patent No. 93,102; also, the Primary Examiner erroneously rejected claims 1-8, 10, and 12-16 as being unpatentable over Fuscaldo U. S. Patent No. 2,297,399 in view of Gachon French Patent No. 876,454 or Bosch Swiss Patent No. 93,102.

8. An oral hearing was held before the United States Board of Appeals on or about October 29, 1962, and after said hearing in said appeal the Board of Appeals rendered its decision on November 7, 1962. In finding no reversible error in the Primary Examiner's action, the Board of Appeals admitted that the disclosure in the Gachon French Patent No. 876,454 was schematic and erroneously held that such disclosure was anticipatory of plaintiff's claims because they do not define his elements to distinguish from the prior art disclosure; also, the Board of Appeals erroneously held that the housing schematically shown in the Gachon French Patent No. 876,454 could be constructed in accordance with the disclosure in the Fuscaldo U. S. Patent No. 2,297,399 in

such a manner as to provide a structure barring patent protection to plaintiff.

9. Plaintiff on or about December 4, 1962, proceeding under Rule 197 of the United States Patent Office Rules of Practice, petitioned for rehearing, reconsideration and modification of the Board of Appeals' decision and this petition for reconsideration was denied by the Board of Appeals on December 17, 1962. The Board of Appeals, in its action on plaintiff's petition for reconsideration, considered the disclosures in the Moard U.S. Patent No. 1,333,626 and Herion U. S. Patent No. 2,853,659 and erroneously concluded on the basis of the disclosures in Moard U.S. Patent No. 1,333,626 and Herion U. S. Patent No. 2,853,659 that the disclosure in the Gachon French Patent No. 876,454 is such that to make the T-shaped member of non-magnetic material would be obvious to a person having ordinary skill in the art, the person being anyone of average engineering knowledge.

10. The Patent Office erred in failing to appreciate that the combinations defined by each of claims 1-16 are patentable to plaintiff.

11. The Patent Office erred in failing to appreciate that the claimed combinations defined in claims 1-16 define a new and useful contribution to the art.

12. The Patent Office erred in failing to appreciate that the disclosure in the Gachon French Patent No. 876,454 is a disclosure in a foreign patent and as such is to be measured not by what may be made out of it, but what is clearly and definitely expressed in it in accordance with the numerous decisions by this Honorable Court in interpreting the disclosures in foreign patents.

13. The Patent Office incorrectly interpreted the disclosure in the Gachon French Patent No. 876,454 and erroneously concluded that to anyone of average engineering knowledge in the field it should be beyond doubt that a non-magnetic member is obvious to produce desired efficiency.

14. The Patent Office failed to consider that the invention defined by claims 1-16 satisfied a long felt want and met with commercial success and specifically failed to consider and appreciate plaintiff's affidavit which he executed on October 11, 1962 and which was filed in the Patent Office on or about October 12, 1962.

15. The Patent Office failed to appreciate that persons skilled in the art would construct the device schematically shown in the Gachon French Patent No. 876,454 in a manner different from that claimed in claims 1-16.

16. Plaintiff has taken no appeal to the United States Court of Customs and Patent Appeals of the Patent Office affirming the rejection of claims 1 to 16.

17. Plaintiff will produce in Court a duly authenticated copy from the records of the Patent Office of his said application Serial No. 661,837 and said application Serial No. 267,178, and all proceedings thereon in the Patent Office.

18. Plaintiff is willing and hereby offers to pay all expenses of his suit, if and when ascertained by this Honorable Court, and any and all lawful fees and charges arising from and incidental to said application, and an issuance of Letters Patent thereof.

19. The invention set forth in claims 1 to 16 in said application Serial No. 661,837 is new and useful and was not known or used by others in this country before the invention and discovery thereof by plaintiff Vincent W. Eckel; the same was not patented nor described in any printed publication in any country before his invention or discovery thereof, and the same was not patented or described in any printed publication in any country before his invention or discovery thereof, and not in public use or on sale in this country for more than one year prior to said application Serial No. 267,178; the said invention or discovery has not been patented in any country foreign to the United States by plaintiff or his legal representatives on an application filed more than twelve months prior to said application Serial No. 267,178.

20. By the decision of the Board of Appeals of the Patent Office, defendant has wrongfully refused and still refuses to issue to plaintiff a patent on his said application Serial No. 661,837, including claims 1 to 16 thereof.

Wherefore plaintiff brings this action and prays this Honorable Court:

To Adjudge that plaintiff is entitled to receive a patent for the invention specified in claims 1 to 16 of said United States application Serial No. 661,837, and to authorize defendant to issue such patent on compliance by plaintiff with the requirements of law, and for such

further or other relief as to which plaintiff may be entitled in the premises.

Vincent W. Eckel,
Plaintiff.

By His Attorney

Dated: January , 1963

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of Counsel

Filed Jan. 16, 1963.

[Title of District Court and Cause.]

Answer to Complaint.

To the Honorable the Judges of the United States
District Court for the District of Columbia

1. The defendant admits that plaintiff, Vincent W. Eckel, is a citizen of the United States. The defendant asserts that, otherwise, he is without knowledge or information sufficient to form a belief as to the truth of the allegations of paragraph 1 of the complaint.

2, 3. The defendant admits the allegations of paragraphs 2 and 3 of the complaint.

4. The defendant admits that plaintiff, Vincent W. Eckel, duly filed in the United States Patent Office an application for patent. The defendant asserts that, otherwise, he is without knowledge or information sufficient to form a belief as to the truth of the allegations of the first sentence of paragraph 4 of the complaint. The defendant also admits that said application was filed on January 18, 1952, and was given Serial No. 267,178. Otherwise, however, the defendant denies the allegations of the second sentence of paragraph 4 of the complaint. The defendant denies the allegations of the third sentence of paragraph 4 of the complaint.

5, 6. The defendant admits the allegations of paragraphs 5 and 6 of the complaint.

7. The defendant admits that in an Examiner's answer mailed on January 4, 1961, the Primary Examiner again rejected claims 1-16 as being unpatentable

over the Gachon French Patent No. 876,454; that the Primary Examiner rejected claims 1-8, 10, and 12-16 as being unpatentable over Hammond U. S. Patent No. 2,420,241 in view of Heninrich German Patent No. 662,027, Gachon French Patent No. 876,454 or Bosch Swiss Patent No. 93,102; and that the Primary Examiner rejected claims 1-8, 10, and 12-16 as being unpatentable over Fuscaldo U. S. Patent No. 2,297,399 in view of Gachon French Patent No. 876,454 or Bosch Swiss Patent No. 93,102. Otherwise, however, the defendant denies the allegations of paragraph 7 of the complaint.

8. The defendant admits that an oral hearing was held before the United States Patent Office Board of Appeals on October 29, 1962, and after said hearing in said appeal, the Board of Appeals rendered its decision on November 7, 1962. Otherwise, however, the defendant denies the allegations of paragraph 8 of the complaint.

9. The defendant admits that plaintiff on or about December 4, 1962, proceeding under Rule 197 of the United States Patent Office Rules of Practice, petitioned for rehearing, reconsideration and modification of the Board of Appeals' decision and this petition for reconsideration was denied by the Board of Appeals on December 17, 1962. Otherwise, however, the defendant denies the allegations of paragraph 9 of the complaint.

10, 11, 12, 13, 14, 15. The defendant denies the allegations of paragraphs 10, 11, 12, 13, 14, and 15 of the complaint.

16. The defendant admits the allegations of paragraph 16 of the complaint.

17. The defendant asserts that he is without knowledge or information sufficient to form a belief as to the truth of the allegations of paragraph 17 of the complaint.

18. The defendant admits the allegations of paragraph 18 of the complaint.

19. The defendant denies that the invention set forth in claims 1 to 16 in application Serial No. 661,837 is new and useful and was not known or used by others in this country before the invention and discovery thereof by plaintiff, Vincent W. Eckel; that the same was not patented nor described in any printed publication in any country before his invention or discovery thereof and that the same was not patented or described in any printed publication in any country before his invention or discovery thereof. The defendant asserts that, otherwise, he is without knowledge or information sufficient to form a belief as to the truth of the allegations of paragraph 19 of the complaint.

20. The defendant denies the allegations of paragraph 20 of the complaint.

Further Answering, the defendant asserts that the plaintiff is not entitled to a patent containing any of claims 1 through 16 of his application Serial No. 661,837 involved in this civil action for the reasons given and in view of the references cited in the Exam-

iner's answer and the decisions of the Board of Appeals in that application. Profert hereby is made of copies of the said answer, decisions, and references.

Respectfully submitted,

/s/ C. W. Moore,

Solicitor, United States Patent Office
Attorney for Defendant

February 28, 1963

I hereby certify that two copies of the foregoing Answer To Complaint were mailed today to Mr. Harry W. F. Glemser, Shoreham Building, Washington 5, D. C., attorney for the plaintiff.

C. W. Moore,
Solicitor

[Title of District Court and Cause.]

**Plaintiff's Proposed Findings of Fact and
Conclusions of Law.**

FINDINGS OF FACT

1. This Civil Action, brought under the provisions of 35 USC 145, seeks judgment from this Court authorizing the Commissioner of Patents to issue to plaintiff a patent on a new and useful improvement in Solenoid Operated Actuator and Valve, as particularly specified as claims 1 through 16 of application Serial No. 661,837, filed May 27, 1957.

2. The specification of the application here involved discloses an electromagnetic solenoid type actuator that is particularly suitable for actuating a valve. The device lends itself to miniaturization and actuating mechanisms at remote or at not readily accessible locations such as in the aircraft and space industry. The device disclosed in the application comprises a coil, an external housing for said coil of magnetizable material with pole portions of the said housing extending into each end of the hollow portions of said coil to form a single and centrally disposed air gap therein, whereby said coil with the exception of said gap is completely surrounded by magnetizable material. One of said pole portions comprises a cylinder and is adapted to receive a plunger therein so that the plunger may move reciprocatingly within the hollow portion of the cylinder, the other of said pole portions being adapted to provide a magnetizable stop adapted to attract the magnetizable plunger and limit the

movement thereof. The foregoing comprises the basic elements of the invention whereby applicant has provided a unique magnetizable casing which simultaneously performs the functions of concentrating the entire magnetic flux established by the coil in the internal central portion of the coil, providing a spool for mounting the coil, and providing integral guide and stop means for intimately engaging the plunger so as to concentrate the magnetic flux almost entirely therethrough. This inventive solenoid actuator combination also may be adapted to comprise a valve for directing fluid through the coil by drilling communicating fluid conduits centrally through the stop portion of the casing and centrally of the plunger and by also providing a valve in combination with said plunger externally of the coil.

3. The claims in issue are claims 1 through 16 and for convenience the invention as claimed therein is discussed with particular reference to claims 5, 7, and 11. Claims 5, 7, and 11 at issue are directed to a solenoid actuator having a solenoid coil, a magnetizable plunger disposed centrally of the coil, and a magnetizable casing surrounding the solenoid coil and including opposed pole portions extending into the coil so that one portion guides the plunger, the pole portions defining a gap centrally of the coil. Claim 7 differs from claim 5 in specifying that one pole piece comprises a stop and further specifying that the gap between pole portions is filled with a non-magnetic sleeve. Claim 11 further specifies over claim 7 in reciting the actuator as a valve

means and in particularly reciting the valve closure elements disposed at one end of the coil, not within the coil.

4. The defendant relies upon the following patents having the disclosures described below and contends that the subject matter of claims 1 through 16 is obvious in view of said disclosures:

(a) The French patent No. 876,454 to Gachon, issued November 6, 1942, discloses a solenoid actuated valve. The drawing of the patent is schematic and the specification of the said patent does not disclose the material of which the casing for the coil and the material of which the spacer member positioned within the coil are constructed. The casing and spacer member are not mentioned in the specification of the patent. The Gachon patent drawing or sketch shows a combination armature and valve member and a seat for said member positioned entirely within the coil. The seat for the said armature or plunger is shown in the sketch as formed integral with the casing for the coil portion of the said device. There are peripheral passages formed on or in the said plunger. The Gachon sketch shows an air gap at each end of the plunger or armature portion.

(b) The patent to Fuscaldo, U.S. Patent 2,297,399, issued September 29, 1942, discloses a solenoid actuator. The pole pieces are positioned at the ends of the coil portion thereof and do not extend within the coil to form a centrally positioned air gap. Fuscaldo discloses a non-magnetic sleeve member positioned internally of the said coil and extending the entire length thereof.

5. There is no disclosure in the above noted patents of an electromagnetic solenoid type actuator having a casing of magnetizable material which includes pole pieces extending into the solenoid coil so as to define a gap centrally of the coil nor do they show a magnetizable casing including pole portions adapted to act as combined guiding means and stop means for a plunger disposed centrally within the solenoid coil nor do they teach the combination of such a magnetizable casing having integral pole portions and defining a gap centrally of the coil, this gap being filled with a non-magnetic sleeve.

6. The invention described and claimed in the application in suit is not disclosed in either of the above-mentioned Gachon or Fuscaldo patents.

7. The device as described in the plaintiff's application and claims in issue herein is new and useful.

8. Solenoid actuators built in accordance with the claims in issue herein have been used in large quantities by the aircraft and space industry.

9. Solenoid actuators built in accordance with the claims in suit are considered surprisingly and unexpectedly effective by those skilled in the solenoid actuator art including leaders in the aircraft and space industry.

10. The invention as described and claimed in the application in issue herein has filled a long felt need in the solenoid actuator art.

11. The differences between the subject matter of the claims in suit and the prior art relied upon by the defendant are such that the subject matter, as a whole, would not have been obvious at the time the invention was made to a person skilled in the solenoid actuator art.

CONCLUSIONS OF LAW

1. The Court has jurisdiction over the subject matter of the action and over the parties to said action.

2. Plaintiff is entitled to have Letters Patent granted for the invention in claims 1 through 16 of the application in suit herein, i.e. application Serial No. 661,837, filed May 27, 1957.

3. The Commissioner of Patents has the authority to issue to plaintiff Letters Patent containing claims 1 through 16 in issue herein.

Judge, U.S. District Court

[Affidavit of Service by Mail Attached.]

[Title of District Court and Cause.]

Stipulation.

It is hereby stipulated by and between the parties, through their respective attorneys, that the Official Transcript of Proceedings Before the Honorable Joseph A. Jackson, Judge, dated Thursday, April 16, 1964, should be read with the following two corrections:

Page 63, lines 16 and 19-20, in each instance for "nonmagnetic" reads — magnetic —.

/s/ C. W. Moore,
Solicitor, U.S. Patent Office
Attorney for Defendant

/s/ Ellsworth H. Mosher,
Attorney for Plaintiff

Filed May 18, 1964.

[Title of District Court of Appeal.]

Defendant's Proposed Findings of Fact.

1. This is an action under Section 145 of Title 35 of the United States Code in which the plaintiff, Vincent W. Eckel, sought to have the Court adjudge that he is entitled to receive a patent on his application, Serial No. 661,837, filed in the Patent Office on May 27, 1957, entitled "Solenoid Operated Actuator and Valve."

2. The application in suit is directed to a valve and an electromagnetic operator therefor. The operator includes a coil to create magnetic flux when energized, an external housing for the coil of magnetizable material, pole portions extending into each end of the coil, a movable armature slidably mounted within one of the pole portions to be attracted by the other pole when the coil is energized, and a sleeve of non-magnetizable material disposed between the adjacent ends of the pole portions. The armature may be provided with an end portion serving as a valve member adapted to seat on a cooperating valve member mounted on the casing.

3. The French patent to Gachon, No. 876,454, shows an electromagnetically operated valve having a coil, a casing surrounding the coil having annular portions extending into each end of the coil, an annular member of T-shaped cross-section between the inner ends of the annular portions, a movable core slidably mounted within one of the annular portions, and a stationary member mounted on the other annular portion to serve as a stop. The Gachon drawing shows a line, stated in the specification to represent a magnetic circuit, which passes through the casing, one of the annular portions, the stop member mounted thereon, the working gap, the movable

core, and the other annular portion. The line does not pass through the T-shaped member.

4. The Fuscaldo patent, No. 2,297,399, is directed to a fuel injector for internal combustion engines which includes an electromagnetic operator for a valve having a coil enclosed within a sectional casing of magnetizable material, a portion of an end casing member extending within the coil, a sleeve of non-magnetizable material between that portion and the other end casing member, a movable armature having a close sliding fit with the latter casing member, and a stop member of magnetizable material mounted on the first end casing member. The armature is attached to a valve stem by a non-magnetizable hub, and the valve is located a substantial distance from the coil.

5. Plaintiff did not prove that a magnetic effect would be created between the Gachon valve parts which would significantly affect the operation of the valve.

6. By reason of the representation of the magnetic circuit in Gachon those skilled in the electromagnet art would understand that the casing and the inwardly extending annular portions are made of magnetizable material. Plaintiff, in fact, informed the Patent Office tribunals that the casing is "undoubtedly of magnetic material."

7. It would be obvious to those skilled in the electromagnet art to make the T-shaped member in Gachon of non-magnetizable material, particularly in view of Fuscaldo.

8. It would be obvious to those skilled in the electromagnet art, in view of the Fuscaldo patent to place the Gachon valve at a distance from the coil and to provide Gachon with a movable core having a central passage

and a close sliding fit between it and the inwardly extending annular member on which it is mounted.

9. Evidence as to the satisfying of a long-existing need by plaintiff's valve is ineffective as evidence of unobviousness because (a) other patents have been granted on the valve, and (b) there is an absence of evidence that those in the art generally had actual knowledge of the Gachon and Fuscaldo patents.

10. The differences between the subject matter of claims 1 to 16 of the application in suit and the prior art are such that the subject matter as a whole would have been obvious at the time plaintiff devised his apparatus to a person having ordinary skill in the solenoid operated valve art.

DEFENDANT'S PROPOSED CONCLUSIONS OF LAW

1. Testimony introduced by a plaintiff in an action under 35 U.S.C. 145 which, without explanation, contradicts statements made by plaintiff to the Patent Office is entitled to little or no weight.

2. Evidence as to long-existing need for a claimed device is ineffective as an indication of unobviousness where a patent has already been granted on the device.

3. Evidence as to long-existing need for a device is ineffective as an indication of unobviousness absent evidence that those in the art generally had actual knowledge of the cited prior art.

4. Plaintiff is not entitled to a patent containing any of claims 1 to 16 of his application Serial No. 661,837.

5. The complaint should be dismissed.

.....
Judge

UNITED STATES DISTRICT COURT FOR THE
DISTRICT OF COLUMBIA

Civil Action No. 153-63

VINCENT W. ECKEL,

Plaintiff,

v.

DAVID L. LADD,

Commissioner of Patents,

Defendant.

Judgment.

This action came on to be heard at this term, and
thereupon upon consideration thereof, it is this
day of, 1964.

Adjudged that the complaint be and it is hereby
dismissed, with costs against plaintiff.

.....
Judge

[Affidavit of Service by Mail Attached.]

[Title of District Court and Cause.]

Plaintiff's Objections to Defendant's Proposed Findings of Fact, Conclusions of Law, and Order.

It is respectfully submitted that except as to defendant's proposed Finding of Fact No. 1 that the said Findings are incomplete and/or unsupported by the record.

Defendant's proposed Finding No. 2 is incomplete in failing to state that the "cooperating valve member" is mounted on the casing so as to be on the outside of the confines of the coil, as indicated in the claims. This external disposition of the valve seat is recited in the claims, for instance, in lines 3 and 4 of claim 11 describing its disposition in "end elements" located externally of the confines of the coil and such disposition is clearly shown in the drawings and specifications.

The defendant's proposed Finding No. 3 is incomplete in that the dotted line in Gachon represents only one of many magnetic circuits. Still further, the Finding does not suggest that Gachon provides more than one working gap in the event the casing is made of a magnetic material as called for in the claims in issue herein.

Defendant's proposed Finding No. 4 relating to the Fuscaldo Patent No. 2,297,399 is respectfully submitted to be confusing, incomplete, and not supported by the record. More particularly this Finding fails to distinguish the Fuscaldo patent as drawn to a T-type actuator as opposed to the co-axial type of the instant case. This distinction is needed to make it apparet that the location of the valve a distance from the coil is only conventional for a T-valve where it would be unconventional in a co-

axial structure. This Finding also conflicts with the record in stating that the sleeve is "between" portions of the casing member, at least one of which portions extends into the coil. This description would locate the sleeve as coplanar with such reentrant casing portions and while the sleeve of the instant application is so located, that of Fuscaldo is definitely not. This also brings in focus the fact that there is really only one pole portion of the Fuscaldo casing within his coil. This Finding is also incomplete in indicating that the Fuscaldo armature or plunger fits closely with the casing whereas the disclosure of the Fuscaldo patent indicates the presence of a definite gap (column 2, lines 4 through 11). The fact that the gap is specified as being of minimum dimensions does not change the fact that it is there, whereas in the instant application there is effectively no gap present between the armature and casing therefor. A further objection to this Finding is that it is not relevant to the issues herein in that as Mr. McCoy testified the art had searched for many years to overcome the shortcomings of such T-type solenoid operated valves.

Plaintiff submits that the defendant's proposed Finding No. 5 is in direct conflict with the evidence. First of all, it is rather likely that anyone endeavoring to follow the teaching of Gachon would make the casing of non-magnetic material to avoid the formation of opposing air gaps. In the event opposing air gaps were formed, such gaps would be self-defeating and contrary to good engineering practice as noted from the record, Tr. 54, 55, and 56. Still further, the Court readily appreciated that opposing air gaps would not be desirable, Tr. 67.

Plaintiff objects to defendant's proposed Finding No. 6 in that it is clearly contra to the testimony set forth on pages 56, 57, and 71 through 75 of the transcript. In addition thereto, plaintiff's counsel called his expert's attention to Roters work on ELECTROMAGNETIC DEVICES. This work, as may be noted from Exhibit A attached hereto, clearly discloses that one cannot ascertain the nature of a material as to whether or not it is magnetic by the presence of dotted magnetic force or flux lines. In the accompany Exhibit A, the drawings 246, 267, and 293 all show dotted lines of force passing through a non-magnetic material, i.e. brass. It is axiomatic that in an action pursuant to 35 USC 145 a plaintiff may make a more thorough study of a matter than his Patent Office presentation and as was the case he produced expert testimony showing that one cannot ascertain the nature of a material as to whether it is magnetic or non-magnetic from a showing of flux lines. Although the testimony in this regard was uncontradicted at the trial, plaintiff has attached hereto as Exhibit A pages from the text referred to by the witness at page 56 of the transcript.

Plaintiff likewise objects to the defendant's proposed Finding No. 7 in that the expert testimony made it clear there is nothing in the Gachon patent to indicate the material of either the T-shaped member or the casing, see Tr. 56, 57, and Tr. 71 through 75.

Plaintiff objects to the defendant's proposed Finding No. 8 first in that there is neither testimony nor any suggestion in either the Fuscaldo patent or the Gachon patent to support the proposed Finding. In fact, Fuscaldo relates to T-type valves and the art searched and waited a long time before the plaintiff herein supplied

the shortcomings of said art. Still further, column 2, lines 4 through 11, of the Fuscaldo patent give additional support to plaintiff's objection thereto.

Plaintiff objects to defendant's proposed Finding No. 9 in that it is not supported by the record and it has no legal relationship to the issues herein. This matter is reviewed commencing with the last paragraph on page 6, page 7, and page 8 of plaintiff's Reply Brief herein. Most particularly, the Court made it very clear from its questions directed to the plaintiff that the device that had met a long felt need in the industry was made in accordance with the patent application, Tr. 126.

Finally, plaintiff must object to proposed Finding No. 10 suggesting that his solution is obvious to one skilled in the art. To reach such a conclusion one would have to assume that the great government laboratories at Wright Field; the laboratories of the major aircraft concerns; and the space industry were derelict in their mission of endeavoring to reduce the weight of the valve components if building plaintiff's device with its five to one saving in weight were obvious, Tr. 117. The Court from its comments readily appreciated that a device made in accordance with the application and claims in issue had made a real contribution to the permissible payload in spacecraft. In fact, saving ounces even in aircraft continues to be newsworthy in science. A week or so ago, the Science section of TIME magazine relates that in the new 550,000 pound XB-70A aircraft the skin of the plane will be chemically sculptured to save ounces of weight. It is submitted that on the record herein plaintiff's contribution was not obvious and the said proposed Finding No. 10 is not in keeping with the record.

In view of the foregoing, it is submitted that defendant's proposed Conclusions of Law and Order are not supported by facts in the record. It appears that the whole thrust of defendant's case is in the form of an objection to uncontradicted evidence submitted at the trial that went beyond the showing made in Patent Office arguments. This Court wisely ruled at the trial that it preferred to hear evidence on all issues over objections by the defendant thereto. It is submitted that on the various issues including the fact that one cannot detect whether a material is magnetic or non-magnetic by a dotted flux line the evidence was uncontradicted. In addition, as aforementioned, said testimony is in keeping with a standard textbook relating thereto, i.e. Roters, referred to by plaintiff's expert at the trial, relevant pages of which are attached hereto.

In view of the foregoing, it is believed in order for this Court to reject defendant's proposed Findings 2 through 10; adopt plaintiff's Findings, and give judgment for plaintiff. Such action is respectfully solicited.

Respectfully submitted,

Kendrick and Stolzy

Elwood S. Kendrick

Stevens, Davis, Miller & Mosher

Ellsworth H. Mosher

/s/ By Elwood S. Kendrick

Attorneys for Plaintiff

Dated: June 10, 1964.

[Affidavit of Service by Mail Attached.]

UNITED STATES DISTRICT COURT FOR THE
DISTRICT OF COLUMBIA

Civil Action

No. 153-63

VINCENT W. ECKEL,

Plaintiff,

vs.

DAVID L. LADD, COMMISSIONER OF PAT-
ENTS,

Defendant.

Opinion.

This is an action under Section 145, Title 35, of the United States Code in which the plaintiff, Vincent W. Eckel, seeks to have the Court authorize the defendant, Commissioner of Patents, to issue Letters Patent of the United States containing Claims 1 through 16 of his application, Serial No. 661,837, filed in the Patent Office on May 27, 1957, entitled "Solenoid Operated Actuator and Valve."

The invention described in the application is directed to a valve and an electromagnetic device for operating it. The device includes a coil which creates magnetic flux when energized, a housing which surrounds the coil and is made of magnetizable material, a pair of pole portions on the housing which extend into each end of the coil, a movable armature mounted within one of the pole portions and attracted by the other pole portion when the coil is energized, and a sleeve of non-magnetizable material disposed between the adjacent ends of the opposing pole portions. The armature is provided with an end portion which serves as a valve member adapted

to seat on a cooperating valve member mounted on the casing.

The tribunals of the Patent Office denied the plaintiff's patent in a decision based upon the language of 35 U.S.C. 103, which prohibits patent protection "... if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains". In support of this decision the Patent Office relied upon a French patent to Gachon, No. 876, 454, a Swiss patent to Bosch, No. 93,102, a German patent to Henrich, No. 662,027, and United States patents to Fuscaldo, No. 2,297,399, and to Hammond, No. 2,420,241. Only the Gachon and Fuscaldo patents were material to the issues developed at trial.

The Gachon patent, dated August 3, 1942, discloses the following construction: an electromagnetically operated valve having a coil, a casing surrounding the coil with annular portions extending into each end of the coil, an annular sleeve of T-shaped cross-section positioned between the inner ends of the annular casing portions, a movable core (or armature) mounted within one of the annular portions, and a stationary member mounted on the other annular portion to serve as a stop. The drawing of the patent also shows a line, stated in the specification to represent a magnetic circuit, which passes through the casing, one of the annular portions, the stop member mounted thereon, the movable core, and the other annular portion. The line does not pass through either the valve seat or the T-shaped annular sleeve.

The Fuscaldo patent, granted September 29, 1942, is directed to a fuel injector for internal combustion engines having an electromagnetic device for operating a valve. The device includes a coil enclosed within a sectional casing of magnetizable material, a portion of an end casing member which extends within the coil, a sleeve of non-magnetizable material between that portion and another end casing member, a movable armature having a close sliding fit with the latter end casing member, and a stop member of magnetizable material mounted on the first and casing member. The armature is attached to a valve stem by a non-magnetizable hub, and the valve is located a substantial distance from the coil.

It was generally admitted at trial that the components of the Gachon device and the manner in which they were assembled was highly similar to the subject matter plaintiff claimed as his invention. The plaintiff's principal effort was to establish that his device was constructed of different *materials* than that of Gachon. The Patent Office contended the materials of both devices were the same.

The language of the Gachon patent did not state whether either the valve casing or the annular T-shaped sleeve shown by its drawings was made of magnetizable or non-magnetizable material. The plaintiff's claims required that the casing be of magnetizable material, and that the sleeve be of non-magnetizable material.

Expert testimony was introduced by the plaintiff which sought to establish that the purpose of the Gachon device would have been frustrated had the casing been

made of magnetizable material. Essential to the rationale of this testimony was the assertion that a "second air gap" would thus be created between Gachon's movable core and the casing within which the core was mounted. This gap, it was said, would counteract the desired effect of the "working" air gap, and would occur between the outer end of the movable core and the outer region of the annular portion of the casing, which was utilized by Gachon for a valve seat.

This rationale, in the Court's opinion, was effectively rebutted by the Patent Office's demonstration that the line representing Gachon's magnetic circuit passed directly through the portion of his casing asserted to be non-magnetic by the plaintiff, but not through the space between the core and the valve seat plaintiff asserted to be the "second air gap". This proved to the Court's satisfaction, when taken with other evidence tending to show that lines representing magnetic circuits usually are assumed to pass through magnetizable material, that the Patent Office had a sound basis for concluding that due to the valve seat's position, the Gachon device was operable with a magnetizable casing.

Similarly, provision of a non-magnetizable sleeve within the core of a coil was shown by the Fuscaldo patent to be a conventional method for concentrating magnetic force upon a "working" air gap. To assert that the annular sleeve of Gachon, identically positioned, was not used for the same purpose is to completely ignore its existence in the drawing. No other reason was advanced for its presence, and no other reason seems plausible. It must be concluded that although the language of the patent does not expressly say so, Gachon's sleeve of T-

shaped cross-section was made of non-magnetizable material.

With the above interpretation of the Gachon patent, it appears to the Court that the plaintiff's structure is completely disclosed. Manifestly, the Court cannot say that plaintiff's subject matter would have been unobvious in view of Gachon and Fuscaldo to a person skilled in the art to which all of these disclosures pertain.

The other principal contention advanced by the plaintiff was that his device satisfied a long-felt want in the aircraft and space industry for lightweight valves. Although significant evidence was presented upon this point, the Court does not deem it sufficient to overcome what it considers to be a clear disclosure of the claimed subject matter by the prior art.

Accordingly, the Court finds for the defendant, against the plaintiff, and will dismiss the Complaint.

The above Opinion contains Findings of Fact and Conclusions of Law.

Dated: October 5, 1964.

/s/ Joseph R. Jackson
United States District Judge

Filed October 5, 1964.

[Title of District Court and Cause.]

Order.

This cause came on for trial on April 16, 1964. Upon consideration of the record herein, as well as the briefs which the Court accorded counsel for plaintiff and defendant an opportunity to file, it is this 5th day of October, 1964,

Ordered, that judgment be, and the same is hereby entered in favor of defendant, and that the Complaint be, and is hereby dismissed, with costs to be assessed against plaintiff.

/s/ Joseph R. Jackson
United States District Judge

Filed October 5, 1964.

UNITED STATES DISTRICT COURT FOR THE
DISTRICT OF COLUMBIA

Civil Action No. 153-63

VINCENT W. ECKEL,

Plaintiff,

v.

DAVID L. LADD,
Commissioner of Patents,

Defendant.

Notice of Appeal.

Notice is hereby given, under the provisions of Rule 73 of the Federal Rules of Civil Procedure, that Plaintiff, Vincent W. Eckel, above named, hereby appeals to the United States Court of Appeals for the District of Columbia from the Final Order of United States District Court, Judge Joseph R. Jackson presiding, entered on October 5, 1964, ordering that judgment be entered in favor of Defendant and that the complaint herein be dismissed with costs assessed against Plaintiff.

Dated: December 1, 1964.

William Douglas Sellers

George A. Brace

Munson H. Lane

By /s/ W. D. Sellers

W. D. Sellers

Attorneys for Plaintiff-Appellant

[Affidavit of Service by Mail Attached.]

UNITED STATES COURT OF APPEALS
FOR THE DISTRICT OF COLUMBIA

Appeal No. 19,105
Civil Action No. 153-63

VINCENT W. ECKEL,

Plaintiff,

v.

DAVID L. LADD,
Commissioner of Patents,

Defendant.

**Plaintiff-Appellants' Statement of Points in Accord-
ance With General Rule 15 of This Court.**

The points on appeal on which Plaintiff-Appellant relies include the following errors of the District Court:

1. In holding that Plaintiff's invention disclosed and claimed in Application Serial No. 661,837 is unpatentable in view of the French patent to Gachon 876,454.
2. In holding that Plaintiff's invention disclosed and claimed in Application Serial No. 661,837 is unpatentable in view of the patent to Fuscaldo 2,297,399.
3. In holding that Plaintiff's invention disclosed and claimed in Application Serial No. 661,837 is unpatentable in view of the combined teachings of the patents to Gachon 876,454 and Fuscaldo 2,297,399.
4. In finding Gachon's vague and incomplete teachings to be adequate to enable a person of ordinary skill in the art to make a magnetic actuator meeting the exacting requirements of spacecraft.

5. In finding the foreign patent to Gachon, French 876,454, with its vague and incomplete teachings to be adequate to anticipate the claimed invention in view of the teaching of Fuscaldo that every design detail of such an actuator is critical.

6. In finding Gachon, French 876,454, to be adequate to teach one of ordinary skill in the art how to build the high efficiency magnetic actuator of the claimed invention using a variety of specific materials in precise relationship to one another which finding overlooks the fact that Gachon fails to specify the properties or the particular material required for the part of his magnetic actuator.

7. In finding that Gachon by itself is adequate to teach Plaintiff's invention meeting performance specifications in view of the fact Gachon's entire description of his actuator is inadequately disclosed in 13 short lines of his specification (page 1, col. 2, line 48, through line 2 of page 2).

8. In finding the abbreviated inadequate 13-line description of Gachon 876,454 to be adequate when Fuscaldo required 530 lines fully to describe a magnetic valve of generally similar construction.

9. In holding that the Patent Office made a demonstration respecting the location of Gachon's magnetic circuit.

10. In holding that Gachon's casing was of magnetic material based upon an alleged "demonstration" by the Patent Office (which was not made) of the location of Gachon's magnetic circuit.

11. In holding that "magnetic circuits usually are assumed to pass through magnetic materials" but not through nonmagnetic materials.

12. In holding that the use of magnetic material for Gachon's valve casing would provide a satisfactory valve contrary to the only expert testimony to the effect that Gachon's valve seat would unavoidably form a second magnetic pole opposing the working magnetic pole.

13. In holding that the Patent Office had a sound basis for assuming that Gachon teaches the use of magnetic material for his valve casing merely because Gachon described his magnetic circuit as passing along the valve casing in view of the uncontradicted expert testimony to the effect that magnetic flux flows through both magnetic and nonmagnetic materials.

14. In finding the Gachon Patent 876,454 was of value as an anticipatory prior art construction in view of its failure to teach the structural and functional importance of using particular materials in definite relationship to one another in order to obtain an operable valve.

15. In failing to accept the uncontradicted testimony that no prior art magnetic valve could meet government specifications for spacecraft applications which specifications are satisfactorily met by Plaintiff's valve.

16. In failing to accept the uncontradicted expert testimony that good engineering practice in constructing the Gachon valve would make use of nonmagnetic material for the valve casing; particularly in view of the fact that if Gachon were to use magnetic material he would provide a valve seat which would act as a magnet opposing opening of the valve and contrary to Gachon's invention.

17. In failing to accept the uncontradicted expert testimony that to avoid the self-defeating results of

opposing magnetic poles in constructing the Gachon valve good engineering practice would dictate the use of non-magnetic material for Gachon's casing.

18. In holding that the claimed invention was obvious in view of the prior art and contrary to the uncontradicted testimony that the government laboratories at Wright Field, at major aircraft concerns, and of the space industry, had failed in their efforts to provide a magnetic actuator meeting desired performance standards readily met by Plaintiff's actuator.

19. In holding Plaintiff's invention to be obvious in view of the uncontradicted testimony that his actuator provided a highly reliable, light weight valve for spacecraft which was only $1/5$ to $1/4$ as heavy as other available valves.

In holding the claimed invention unpatentable in view of the uncontradicted testimony which established that Plaintiff's valve was the only product accepted for use in certain critical spacecraft applications, and that his valve has been used in these applications in every earth-encircling flight of a United States Astronaut.

21. In holding that Gachon's undescribed T-shaped sleeve is made of nonmagnetic material.

22. In holding that Gachon's valve casing is made of magnetic material.

23. In holding that the invention set forth in Plaintiff's claims 1 to 16, and each of them, is obvious to a person of ordinary skill in the art and therefore lacking in patentable novelty under the Patent Statutes.

24. In failing to give weight to the unusual commercial success of the invention structure as evidenced by the fact that Plaintiff's valve was the only approved valve for certain critical applications in United States spacecraft.

25. In dismissing Plaintiff's complaint.

26. In adjudging Plaintiff not entitled to receive a patent for the invention specified in claims 1 to 16 of his Application Serial No. 661,837, and in not authorizing Defendant to issue such patent on compliance by Plaintiff with the requirements of law.

Dated: January 13, 1965.

Respectfully submitted,

William Douglas Sellers

George A. Brace

Munson H. Lane

By /s/ W. D. Sellers

W. D. Sellers

Attorneys for Plaintiff-Appellant

[Affidavit of Service by Mail Attached.]

United States District Court for the District of Columbia.

Vincent W. Eckel, plaintiff vs. David L. Ladd, Commissioner of Patents, defendant No. 153-63.

Filed January 5, 1965.

I, Harry M. Hull, Clerk of The United States District Court for the District of Columbia, do hereby certify the annexed to be the original pleadings, including Reporter's Transcripts of Proceedings (2) filed October 5, 1964 and December 30, 1964, Pages 1-140, 3 Envelopes containing Exhibits, and other papers on file in the above entitled cause, and a true and correct copy of the docket entries, as they appear of record in this office; said originals and copy being transmitted to the United States Court of Appeals for the District of Columbia Circuit to constitute the Record on Appeal.

In Tesimony Whereof, I hereunto subscribe my name and affix the seal of said Court, at the City of Washington, this 4th day of January, 1965.

(Seal)

HARRY M. HULL, Clerk

By /s/ Harry M. Hull,
Clerk.

[Title of Court of Appeals and Cause.]

Appellant's Designation of Record to Be Printed.

To the Clerk of the United States Court of Appeals for
the District of Columbia:

Pursuant to the Notice of Appeal filed in the above
entitled action by Plaintiff-Appellant and to the provi-
sions of Rule 16, General Rules of this Court, the
following portions of the record, testimony and evidence
are designated to be printed in the joint appendix to
accompany Plaintiff-Appellant's brief:

GROUP I

1. Docket entries of filing and proceedings;
2. Complaint filed herein for the issuance of Letters
Patent;
3. Answer to Plaintiff's Complaint;
4. Plaintiff's Proposed Findings of Fact and Con-
clusions of Law;
5. Stipulation between the parties hereto re correc-
tion to transcript, filed May 18, 1964;
6. Defendant's Proposed Findings of Fact, Conclu-
sions of Law, and Judgment;
7. Plaintiff's Objections to Defendant's Proposed
Findings of Fact, Conclusions of Law, and Or-
der;
8. Opinion of the Court for the District of Colum-
bia, filed October 5, 1964;
9. Final Order of the United States District Court
for the District of Columbia, filed October 5,
1964, directing dismissal of Complaint;
10. Notice of Appeal filed concurrently herewith;

11. Statement of Points filed concurrently herewith;
12. Clerk's certificate of mailing Notice of Appeal; and
13. This Designation of Record to be Printed and any amendment thereof or supplement thereto.

GROUP II

1. The reporter's entire stenographic transcript of all of the evidence and proceedings at the trial before the Hon. Joseph R. Jackson, District Judge, on each day of trial including April 16 and 17, 1964.

GROUP III

1. Plaintiff's documentary and physical exhibits entered into evidence as identified below:

EXHIBIT NO.

DESCRIPTION

- 1 The following portions and pages of a Certified Copy of File Wrapper and Contents, Patent Application of Vincent W. Eckel, Serial No. 661,837, filed May 27, 1957:
 1. Top Cover bearing certification of Commissioner of Patents, Exh. 1;
 2. Drawing, page 24, Exh. 1;
 3. Specification, pages 1 through 14, Exh. 1;
 4. (a) Claims 1 and 2, Paper No. 16, beginning 9 lines from bottom of page 115, Exh. 1, and continuing through page 116, line 16, Exh. 1;
 - (b) Claims 3 through 11, Paper No. 15, beginning page 85, line 15, Exh. 1, and continuing through page 91, line 15, Exh. 1;
 - (c) Claim 12, Paper No. 16, page 116, lines 17 through 28, Exh. 1;
 - (d) Claims 13 and 14, Paper No. 15, page 92, lines 1 through 9, Exh. 1;
 - (e) Claim 15, Paper No. 16, page 116, lines 29 through 40, Exh. 1; and
 - (f) Claim 16, Paper No. 15, page 92, last four lines, Exh. 1;

5. Final Rejection, Paper No. 10, pages 74, 75, Exh. 1;
 6. Affidavit of Vincent W. Eckel, Paper No. 11, pages 76, 77, Exh. 1;
 7. Examiner's Advisory Action, Paper No. 13, pages 81, 82, Exh. 1;
 8. Notice of Appeal, page 83, Exh. 1;
 9. Applicant's Brief on Appeal, Paper No. 15, pages as follows:
 - (a) Page 84, heading through two-line paragraph, Exh. 1;
 - (b) Pages 93 through 95, Exh. 1;
 - (c) Page 100, beginning with heading "Fuscaldo Patent No. 2,297,399" and extending through line 2, page 102, Exh. 1;
 - (d) Page 104, beginning with heading "Gachon (French) Patent No. 876,454" and extending through page 114, Exh. 1;
 10. Examiner's Answer, Paper No. 16, pages 115 through 121, Exh. 1;
 11. Applicant's Reply to Examiner's Answer, Paper No. 18, pages 123 through 125, Exh. 1;
 12. Affidavit of Vincent W. Eckel, Paper No. 21, pages 132 through 137, and attached Exhibits A through D, pages 138 through 144, Exh. 1;
 13. Opinion of Board of Appeals, Paper No. 21, pages 145 through 148, Exh. 1; and
 14. Opinion of Board of Appeals on Reconsideration, Paper No. 23, pages 159 through 161, Exh. 1;
-
- 1-A Diagram showing magnetic line of force.
 - 1-B Copy of patent application drawing with pertinent portions in Fig. 3 colored red, green, blue, yellow and purple.
 - 2 Blueprint Drawing of Eckel Valve.
 - 4 Blueprint Drawing (Eckel Valve).
 - 8 Enlargement of Drawing of Gachon patent shown in Defendant's Exhibit 1 at Paper D.
 - 8-A U. S. Patent 2,084,030, A. F. Hoppe (Combined Electrically and Hydraulically controlled Valve).
 - 9 Photograph of Eckel Valve on Mercury Capsule.
 - 10 Copy of Letter, April 11, 1962, Bell to Eckel re Mercury Capsule.
 - 10-A Photograph of Various Eckel Valves.

- 11-A Brochure (Prior Art T-Shaped Valve).
- 11-C Market Survey — AiResearch.
- 12 AiResearch Mfg. Co. (Request for Quotation) addressed to V. E. Eckel, dated June 7, 1951.
- 13 Photo of Eckel Valve on SURVEYOR Lunar Landing Project.
- 14 Photo of Eckel Valve in Palm of a Hand.
- 15 Advertisement by AiResearch Mfg. Div. re missile APUs illustrating devices two of which include Eckel Valves.
- 16 List of AEROSPACE Applications of Eckel Valves.
- 20 Enlargement of Patent Application Drawing with pertinent portions colored pink.

GROUP IV

1. The following ones of Defendant's exhibits entered in Civil Action No. 153-63:

EXHIBIT NO.	DESCRIPTION
1	Tab A — U.S. Patent to Fuscaldo No. 2,297,399; Tab D — French Patent to Gachon No. 876,454; drawing and pages 1 through 4 of English Translation.

GROUP V

1. Clerk's Certificate.

Dated: January 13, 1965.

Respectfully submitted,
William Douglas Sellers
George A. Brace
Munson H. Lane
By /s/ W. D. Sellers
Attorneys for Plaintiff-Appellant

[Affidavit of Service by Mail Attached.]

[Title of Court of Appeals and Cause.]

**Appellee's Statement of Parts of Record to Be
Printed in Joint Appendix.**

Pursuant to Rule 16(b) of the Rules of this Court, appellee states that he desires to have printed in the joint appendix the following parts of the record not included in appellant's statement:

1. Page 161 of plaintiff's Exhibit No. 1 (page 3 of the decision of the Board of Appeals "On Petition For Reconsideration");
2. Page 47, lines 1 to 12 (including the word "Sir:") and page 49 to page 53, line 10 of plaintiff's Exhibit No. 1 (heading and pages 3 to 7 of applicant's amendment filed November 4, 1958).

Respectfully submitted,

C. W. Moore,
Solicitor, U. S. Patent Office,
Attorney for Appellee

S. Wm. Cochran,
Of Counsel
January 19, 1965

[Affidavit of Service by Mail Attached.]

Transcript of Proceedings Before United States
Court for The District of Columbia.

UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF COLUMBIA

Civil Action
No. 153-63

VINCENT W. ECKEL,

Plaintiff,

v.

DAVID L. LADD,

Commissioner of Patents,

Defendant.

Washington, D. C.
Thursday, April 16, 1964.

The above-entitled matter came on for trial at 2:00
p.m. before the Honorable Joseph R. Jackson, Judge,
United States District Court.

Appearances:

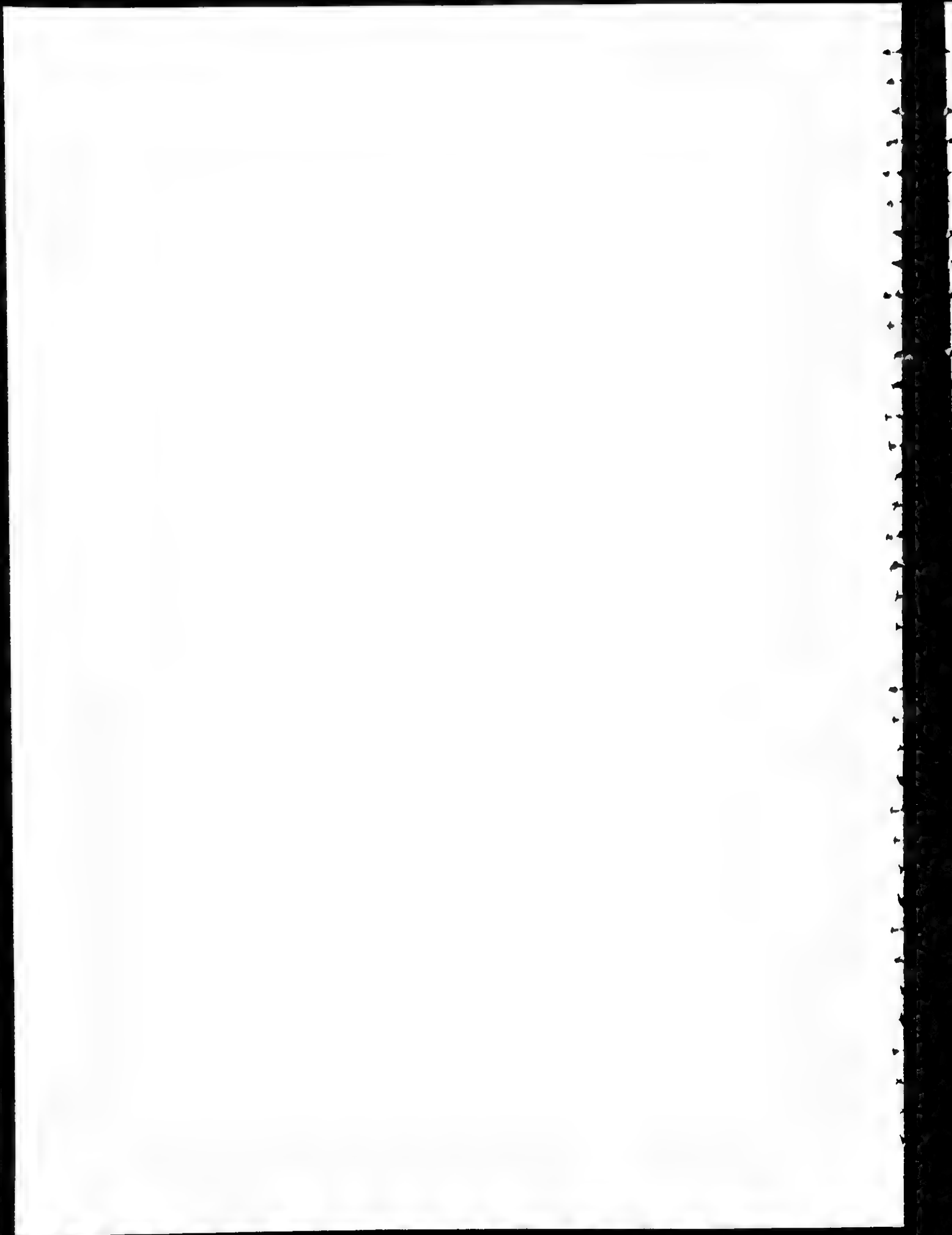
On behalf of the plaintiff:

Elwood S. Kendrick, Esq.
Kendrick and Stolzy
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612 South Flower St.
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Ellsworth H. Mosher, Esq.
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Washington 4, D. C.

On behalf of the defendant:

S. W. Cochran, Esq.
Solicitor's Office
U. S. Patent Office.



CONTENTS

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<u>Witnesses</u>	<u>Direct</u>	<u>Cross</u>	<u>Redirect</u>	<u>Recross</u>
Frank Edward				
Mauritz	64	99	119	123
James L. McCoy	124	X		
Vincent W. Eckel	133	155	X	

EXHIBITS

<u>PLAINTIFF'S EXHIBITS</u>	<u>MARKED</u>	<u>RECEIVED</u>
No. 1 Certified Copy of File Wrapper & Contents, Patent Office Application of Vincent W. Eckel, Serial No. 661837.	61	61
No. 1-A Diagram Showing magnetic line of force	69	77
No. 1-B Copy of patent application drawing with pertinent portions in Fig. 3 colored red, green, blue, yellow and purple.	66	77
No. 2 Blue Print Drawing of Eckel Valve		123
No. 3 Eckel Valve AF 42		*132, 146, 149
No. 3-A Eckel Valve AF 77		**132, 148
No. 3-B (Not used)		
No. 3-C Eckel Valve AF 42 (Cutaway Model)		**132, 148
No. 4 Blue Print Drawing (Eckel Valve)		123
No. 5 Eckel Valve AF 56		148
No. 5-A Eckel Valve AF 70		148
No. 6 Eckel Valve Brochure (Not used)		

(Note: * Exhibit No. 3 Received in Evidence three times.

** Exhibits No's. 3-A and 3-C Received in Evidence twice.)

<u>PLAINTIFF'S EXHIBITS</u>	<u>MARKED</u>	<u>RECEIVED</u>
No. 7 Eckel Valve Literature (Not used)		
No. 8 Enlargement of Drawing of Gachon Patent shown in Defendent's Exhibit 1 at Paper D.		98
No. 8-A U.S. Patent 2,084,030, A. F. Hoppe (Combined Electrically and Hydraulically Controlled Valve)		*155
No. 9 Photograph of Eckel Valve on Mercury Capsule.		150
No. 10 Copy of letter, April 11, 1962, Bell to Eckel re Mercury Capsule.		152
No. 10-A Photograph of Various Eckel Valves.		153
No. 11-A Brochure (Prior Art T-Shaped Valve).		131
No. 11-B Prior Art T-Shaped Valve.		127
No. 11-C Market Survey — AiResearch		153
No. 12 AiResearch Mfg. Co. (Request For Quotation) Addressed to V. E. Eckel, dated June 7, 1951.		153
No. 13 Photo of Eckel Valve on SURVEYOR Lunar Landing Project.		152
No. 14 Photo of Eckel Valve in Palm of a Hand.		133

(Note: *See Note on Page 50.)

<u>PLAINTIFF'S EXHIBITS</u>	<u>MARKED</u>	<u>RECEIVED</u>
No. 15 Advertisement by AiResearch Mfg. Div. re missile APUs illustrating devices two of which include Eckel Valves.		145
No. 16 List of AEROSPACE Applications of Eckel Valves.		149
No. 17 Photographs of Eckel Valve Co.		154
No. 18 Eckel Valve used on Douglas Bombers.		*148, 149
No. 19 Not used.		
No. 20 Enlargement of Patent Application Drawing with pertinent portions colored pink.		98

(Note: * Exhibit No. 18 was received in Evidence twice. Exhibits which are not listed by page number under the column headed "Marked" were marked pursuant to stipulations between counsel during recesses. In this connection, attn. is invited to pages 47, 48 and 38. Plaintiff's Exhibits 8-A, 8-B, 8-C, 8-D and 8-E were apparently marked pursuant to the above-mentioned stipulations. Attn. is invited to pages 44 and 45 of the transcript. However only 8-A (A. F. Hoppe Patent) was identified by the witness at page 45 and it is marked in evidence pursuant to Mr. Kendrick's general offer of all exhibits at page 137 of the transcript.)

<u>DEFENDANT'S EXHIBITS</u>	<u>MARKED</u>	<u>RECEIVED</u>
No. 1 Patent Office Folder in Civil Action No. 153-63 with Tabs A through I.	61	61

PROCEEDINGS

The Court: Read the case, Mr. Clerk.

The Deputy Clerk: Civil Action 153-63, Vincent W. Eckel versus David L. Ladd, Commissioner of Patents.

The Court: Are the parties ready?

Mr. Mosher: The plaintiff is ready, Your Honor.

Mr. Cochran: The defendant is ready, Your Honor.

The Court: All right, Mr. Kendrick, suppose you tell me what it is all about.

Mr. Mosher: My name is Mosher, Your Honor. Good afternoon. I should like to introduce Mr. Elwood S. Kendrick, a member of good standing of the California and Illinois Bars, who will conduct the case.

The Court: I remember Mr. Kendrick very well. I thought you were he at first though. I was misled by what is on this paper. All right, Mr. Kendrick.

OPENING STATEMENT ON BEHALF
OF THE PLAINTIFF.

Mr. Kendrick: If Your Honor please, the application of Mr. Eckel deals with a very unusual configuration of old components into a new shape that serves as an actuating member to open and close the device, and it is particularly suitable for use in a valve.

The Court: It is not a design patent though, is it?

Mr. Kendrick: No, Your Honor. It is an arrangement of old elements that does a surprisingly effective job. [5]

The Court: I understand.

Mr. Kendrick: Now I abhor the use of technical terms, but we may have to use maybe one or two.

The Court: Well, I may ask for an explanation of them.

Mr. Kendrick: I think that anything can be spoken of in relatively simple everyday English terms and, perhaps, it is more understandable to everyone if it is.

If Your Honor happens to have a copy of our trial brief, I would appreciate it if you would turn to the sketch that is attached thereto as Exhibit A.

The Court: Where is it, at the end?

Mr. Kendrick: Yes, Your Honor.

We have the claims and then we have the sketch. No, the claims are Exhibit B. Excuse me, Your Honor. It is Exhibit A. It is at the end of the brief before the start of the claims. It is at page 9. There are 8 pages and then the 9th page is the sketch.

The Court: These pages do not appear to be numbered but I will find it. Before the claims are set out?

Mr. Kendrick: Yes, sir. The brief goes from page 1 through page 8 and then the first exhibit is the sketch. That is the way my copy is put together.

The Court: All right. [6]

Mr. Kendrick: If Your Honor please, again getting back to the arrangement of parts, this arrangement of parts includes a coil which is marked red in the sketch in Figure 3.

The Court: I see it.

Mr. Kendrick: And it is cut in two sections, so on the left side and on the right side you see portions of this coil. Now this coil sets up, when energized, an electro magnetic field that extends into the top portion that is colored green. So this forms one whole of an electro magnet. The green portion is 7, but it is colored green at the top. Now an electro magnetic field is set up

through this green portion. This forms a magnet and this magnet attracts the purple colored member, so that that space between the two is then reduced into a closed position such as is shown in Figure 4. There you will no longer see the gap or space between the green member and the purple member. You will see that these two pieces are now flush against each other.

The magnetic field set up in the coil energizes the green portion and the purple portion and these two portions then mate. And when these two portions mate the bottom portion of the purple member is a valve. And that bottom portion of the purple member is marked number 20 in Figure 3.

The Court: Well it is open in Figure 4 and it is closed in Figure 3, is that it? [7]

Mr. Kendrick: That is correct. The valve is open in 4 and closed in 3.

Now this, in general, is the type of device to which the invention relates. It is an electrically operated actuator. The part being actuated is the purple part, and the real special use of this configuration is for operating valves and in operating valves in a very unusual environment.

The Court: How does the valve open after it has been closed, by cutting off the power?

Mr. Kendrick: When you cut off the power the spring member 23 — Do you notice the spring in the center?

The Court: I see it.

Mr. Kendrick: It is shown in the center of Figure 3. The valve is closed by cutting off the power and it is opened by turning on the power. The valve is open in Figure 4, as Your Honor noted, and it is closed in

Figure 3. When you turn off the power the spring then energizes or activates the plunger member 20 so it seats as a valve.

The electrical current unseats the valve and the spring seats it. In Figure 3 there is no current turned on so there is a space between the purple member and the green member; and the spring is now pushing those two parts apart. And the electrical current is strong enough to overcome the force of that spring and draw the purple member up into contact [8] with the green member down in Figure 4, which is uncolored, and that opens the valve head 20, and there is then a passage out the bottom of the valve as shown by the arrow in Figure 4. At the bottom you will find the arrow there.

Now this valve construction also includes a member in Figure 3 that is colored yellow. Adjoining the red portions in the center there is a thin yellow portion on each side. Now that portion of the valve is made of non-magnetic material, and the casing on the outside of the coil is made of magnetic material. By magnetic I mean material that is magnetizable.

And you will notice, Your Honor, that the portions of the outer casing turn into the chamber of the coil. Namely, there is the green portion at the top and then there is the blue portion at the bottom, which are extensions of the casing surrounding the coil. So you will have a coil here that is surrounded by a magnetic material that extends into this cavity. You have a round coil and around the outside of it, just like if the hand were held —

The Court: Well, what is the function of the non-magnetic material, the yellow?

Mr. Kendrick: The non-magnetic material, spaced as it is, as best as it can be explained, causes the magnetic flux to flow only through the purple member and to flow only through the green member, so that you have a stronger concentration of [9] magnetic flux against that open space, namely the open space, so that when it is energized those two members will come together.

If Your Honor please, your question was an excellent question, you were anticipating us, because that is the next sketch, to show —

The Court: Has counsel seen it?

(Mr. Kendrick conferred briefly with Mr. Cochran at the counsel table.)

The Court: That is just to illustrate your argument, is it?

Mr. Kendrick: That is right, Your Honor. We will introduce this later as an exhibit. Could I hand that up to Your Honor?

The Court: You may.

Mr. Kendrick: Your Honor asked a very good question. If you will note, the flux path now gets concentrated on this space between the two members we have described as magnetic members, the green member and the purple member in the other sketch.

When the current is turned off you lift that overlay and that is the way the device will look in non-operating position. When you turn it on that flux path will set up and cause that gap to close. Now this non-magnetic member is spaced [10] in this position and these end members fold under, as it were, like my hand is shaped here (demonstrating) in this position like an L with a little member on the bottom, and the coil is mounted like

between my fingers and my thumb extends back up into the coil.

And you will notice in your sketch that the green member and the blue member extend back under the coil. But this is part of the casing, and this part of the casing extends down to the yellow member, the non-magnetic sleeve.

Now you will also note. Your Honor, that the plunger, which is referred to as an armature, which is colored purple, there is a close fit. In other words, there is no air gap or space between the purple member and the blue member. In other words, this armature 24 slides in a fitted relationship with the housing member colored blue. There is no space between the blue and the purple members. The only space or air gap in this device is between the ends of the green or purple members, so that the only magnetic field that is set up is that shown in the sketch, Exhibit A, those dotted lines. Those dotted lines flow only in the path shown in that sketch.

Now a surprising thing about this arrangement of parts is that at least since 1890, Your Honor, people have been cutting, arranging and shaping various parts in different kinds of magnetic actuators — and I believe that counsel for [11] the Government will stipulate this — but no one has ever arranged parts in a magnetic actuator in the manner in which they are arranged in this device.

Now the evidence will show that this device is used in an industry where weight is extremely important. For example, only in an aircraft — I have heard the figures used a lot, and I live out where the aircraft industry is in California — the saving of a pound in the weight of an airplane is worth \$400.00. Now the reason for this is

that to carry this one pound of useful load it requires fuel to carry this one pound around. And I understand, and the evidence will show, that when you get into the field of missiles that there is a fight even for ounces of weight because of the fantastic power to weight requirement.

If my memory serves me correct, the figure is that there is a payload of only one percent. So one percent goes up and it takes 99 percent of the weight to get the load aloft.

And I believe that the attorney for the Patent Office will tell you, that if you went over to the Patent Office and took any subject over there and weighed the issued patents on valves and valve actuators they would probably weigh more than all of the patents in any other class in the Patent Office. So here is an extremely crowded art, where a great deal of work has been done, and the inventor, who spent a substantial portion [12] of his life working in valves, came up with a valve, rearranging admittedly only old structure into a new combination, that gave a very surprising result.

The valve that this replaced, the best valve that was known in the industry in one size doing one job weighed about 10-ounces. The inventor of this application took that valve and made a 5-ounce valve. And as far as we know, and as far as our investigation extends, that was the limit.

Now this afternoon, Your Honor, we will show you valves made exactly in accordance with Figure 3 that embody this principle; and Figure 3 is practically a working drawing of the valve. And the valve, unexpectedly, will do all that is expected of it and it weighs less than 1-ounce. Now that this arrangement of old parts

would cause valves to be made and operative that weigh less than 1-ounce came as a real surprise to innumerable valve companies and it gave the Eckel Valve Company the reputation of being a valve-makers valve maker, if you please. So there was a competition among all of the substantially known valve companies in the United States to have the honor and the responsibility, if you please, of providing a valve that would do the job required in our first space endeavor.

The Court: In other words, there was a problem and it has been solved; is that it? [13]

Mr. Kendrick: Yes, Your Honor. And it was solved only by this valve. This is shown here (indicating to a photograph, shown in the palm of this man's hand. It is that size, if you please. That has been the only valve that has been used in the steering mechanism that has ever taken any American to outer space.

The Patent Office's approach to this great accomplishment is that one skilled in the art could take some of the references of record, and by chopping off here and borrowing from another reference of record — and we were told just yesterday, that in addition to borrowing from the second reference, because even when you borrow from those two references you still do not have this valve, that a person should read one verse out of a book that was published in 1890 in England. Now, Your Honor, with all due respect to the Patent Office and all due respect to the Board of Appeals, we are conceding here that these parts are old. But the arrangement of words in wonderful prose in literature has not caused anybody, I don't think, to try to take from great writers the fact that they have made a novel combination of words which have had an impact on all history, because

one could buy a dictionary for ten or fifteen cents and find the words that were used in that great work in the dictionary. And we think that all of the learned people in the Patent Office have rather over- [14] simplified the accomplishment made by this unusual arrangement of parts. This unusual arrangement of parts has filled a longfelt want. One of our witnesses here, Colonel McCoy was in charge over at Wright Field and working in this field of instrumentation, and he will tell you the background and of the search for something that would do this. All of the ablest people in this country were working on this problem. And Mr. Eckel's shop is very small, and his operation today is still small business, because there really isn't a large application where weight is so important, as in aircraft, and since the 707, the jet aircraft, there are not many aircraft made, but where people place importance on having reliable valves operating the pressure systems that make it safe to fly at thirty and forty-thousand feet and maintain sea level to four-thousand feet pressure, people are betting their lives that the systems will work. And at the very heart of those systems you will find Eckel valves, Eckel valves made in a small plant in California, and valves made with this peculiar and novel arrangement of parts.

We think that the Patent Office erred because they clearly overlooked a very staggering success story that was put before them showing what this arrangement of parts did. And all of the big companies were working on this problem — these were people that knew their business, who had spent a [15] lifetime in the valve business—and they didn't solve the problem. The standard of the industry was the T-shaped solenoid valve, which valve for valve weighs about four to one over the Eckel valve.

So there was a real crying need for something and these people were working with the Government and both with and without Government funds, and the answer wasn't forthcoming. And Mr. Eckel, with his own money, and money that was very hard to come by, was able to make this valve that would do this job.

The Court: Of course, we will hear all of that from your witnesses?

Mr. Kendrick: Yes, sir.

The Court: How many witnesses will you have?

Mr. Kendrick: We will have three and possibly four witnesses, Your Honor.

Now turning to the references, the principal reference relied on by the Government is a French patent. And this French patent, as our evidence is going to show, is a very sketchy disclosure. It doesn't specify any of the materials called for. It doesn't specify the materials called for in the claims of our patent.

The Court: What is the date of that patent?

Mr. Kendrick: 1942, Your Honor.

And the evidence will also show that even if some one [16] were to try to follow the teachings of this patent that they are vague and indefinite, and if you do the best job you can—

The Court: Of course, that is something that will have to be shown by witnesses.

I understand your contention.

Mr. Kendrick: All right, Your Honor.

So, in summary, Your Honor, that is our case, that the argument here that it would be obvious in view of the art is not well taken.

And the second point, in light of decisions written by Your Honor, the Patent Office erred in overlooking the way the accomplishment was received by the industry, where the need had existed for a long time and where able people had tried to solve it.

The Court: Do you desire to be heard now, Mr. Cochran?

Mr. Cochran: Yes, Your Honor. I could pinpoint the issue a little further if Your Honor would like me to. I would like to pass up now the Patent Office folder.

The Court: Out of order it may be received.

You had better submit your exhibit 1, the certified copy of the file below, Mr. Kendrick.

Mr. Kendrick: I offer as plaintiff's exhibit 1, Your Honor, the certified copy of the file wrapper and contents [17] of the application of Vincent W. Eckel, Serial Number 661837.

The Court: Mark them both as received in evidence.

The Deputy Clerk: Plaintiff's Exhibit Number 1 and Defendant's Exhibit Number 1 are marked in evidence.

(Plaintiff's Exhibit No. 1 and Defendant's Exhibit No. 1 were received in evidence.)

OPENING STATEMENT ON BEHALF OF THE DEFENDANT.

Mr. Cochran: Now, as Mr. Kendrick pointed out, the rejection is under Section 103, whether or not the claims define anything which is unobvious over the Gachon patent particularly in view of the patent to Fuscaldo. Fuscaldo is paper A in the Patent Office folder and the Gachon is paper D.

Now if you will look at Gachon, particularly to the drawing —

The Court: Which one did you say, D?

Mr. Cochran: Yes, Your Honor, paper D.

You will find first that there is a translation prepared by the Patent Office translator and then the drawing.

The Court: Yes, I see it.

Mr. Cochran: Now the electro magnetic operator, which is pertinent here, is on the right-hand side of the drawing. And I think you can ignore everything to the left [18] of the wall 5. Now the casing for that electro magnetic operator is designated 14. That is a magnetic case. The coil is 16. Now that corresponds to the portion marked red in the drawing attached to the plaintiff's brief. Now that casing, casing 14, you will notice has re-entrant portions, that is it has portions that extend inside the coil. Now the portion on the right extends into the right-hand side of the coil and corresponds to the member which is designated green in the plaintiff's drawing. The portion on the left corresponds to the portion marked blue in the plaintiff's drawing.

Now the first one supports a stationary member which can be considered a stop member which is member 20 in Gachon. The armature or the movable core is designated 17. Now that corresponds to the member which is purple in the plaintiff's drawing.

To the left point the parts appear to be substantially the same and arranged in the same way.

Now the crux of the matter here is the member which is between the re-entrance portions, which is shown cross-hatched here and it is sort of T-shaped in the cross-section. Now that corresponds to the member which is yellow in the plaintiff's drawing.

The Court: It is non-magnetic?

Mr. Cochran: Yes, in the plaintiff's disclosure it is [19] definitely non-magnetic.

And the question here is whether it would be obvious to make that member non-magnetic in Gachon. And that is the only question in the case, I believe. The Board of Appeals held that it would be obvious to make that member non-magnetic if you wanted an operator, an electro magnetic operator, which would take the best effect, the most efficient effect of the magnetic flux available. The question, of course, is whether the Board was clearly wrong in holding this.

The claims, apparently, all stand or fall on that issue. The Board additionally referred to the Fuscaldo patent, which is paper A, merely as showing that it was conventional in the art to make the casing of an operator of this kind sectional so that you could insert the coil. You will see there that there is a casing head 13 at the right-hand side which can be removed and it is attached to the casing by screw threads and the parts can be taken out through that end.

Fuscaldo also shows a member 12, which is non-magnetic, and within which the armature member 5 slides. It too is a valve operator, and the valve in Fuscaldo is shown in Figure 1-A. The valve is actually at the end of a long stem. And Figure 1-B shows the electro magnetic operator which is important here.

Now the other patents you will find in the Patent [20] Office exhibit the Board held to be cumulative only and I think you need not consider them. In other words, you can limit your consideration to Gachon and Fuscaldo.

And, to repeat again, I think that the issue which is determinative here is whether the Board was clearly wrong in saying that it would be obvious to make a T-

shaped member in the Gachon patent of non-magnetic material in order to get the most efficient device.

The Court: Call your first witness, Mr. Kendrick, please.

Mr. Kendrick: Will you call Dr. Mauritz, please. Thereupon —

MR. FRANK EDWARD MAURITZ

was called as a witness by and on behalf of the plaintiff and, having been first duly sworn, was examined and testified as follows:

DIRECT EXAMINATION

By Mr. Kendrick:

Q. Would you state your name for the record, please?

A. My name is Frank Edward Mauritz, M-a-u-r-i-t-z.

Q. And where do you reside, please?

A. 1657 Hilliard Drive, San Marino, California.

Q. And would you tell the Court, please, what formal technical training, if any, that you have had? [21]

A. Yes. In 1937 I graduated from Johns Hopkins University in Baltimore with a Doctor of Engineering Degree, Physics and Mathematics subordinate subjects. And in '37 I joined the General Electric Company in Schenectady as a test engineer and served in that capacity about a year; and also served six months in their research laboratory. And then I entered the General Electric Company Patent Department and worked here in Washington for about three years until I was called into the Army under my reserve commission

where I served under the Chief of Ordnance in the Patent Section.

After leaving the service I was patent attorney for Zenith Radio Company — Zenith Radio Corporation — in Chicago, and was there for about three or four years. Then I moved to California and joined the firm of Lyon and Lyon, where I am presently located.

Q. In addition to your technical studies, have you studied law?

A. Oh, yes. I graduated from George Washington University and I am a member of the California Bar.

Q. And you mentioned you have worked with patents during the period of about the past twenty years?

A. Yes, I have. I would say I have handled at least one-hundred patent applications in valves alone in California. Among my largest clients is General Controls Company. [22]

Q. And have you also studied devices that involve magnetic actions?

A. Yes, of various kinds. Not only of devices but consultations with inventors and engineers who specifically designed them to make improvements in this art.

Q. And are you registered to practice before the United States Patent Office?

A. Yes, I am.

Q. Now inviting your attention to plaintiff's exhibit 1, have you studied the patent application that is found therein in pages 1 through 24?

A. Yes, I have. As a matter of fact, I wrote the application as a continuation-in-part of an earlier application.

Q. Thank you. Now inviting your attention to the drawing on page 24 —

Mr. Kendrick: Would you mark that 1-B?

The Deputy Clerk: Plaintiff's Exhibit 1-B is marked for identification.

(Plaintiff's Exhibit 1-B was marked for identification.)

By Mr. Kendrick:

Q. Could you tell the Court whether or not plaintiff's exhibit 1-B is a copy of the same drawing that is found at page 24 of plaintiff's exhibit number 1? [23]

A. It appears to be.

Mr. Kendrick: If Your Honor please, that is the drawing that I made reference to that is attached to our trial brief, namely the Patent Office drawing that is colored.

By Mr. Kendrick:

Q. Do you understand the construction and mode of operation of the device that is disclosed in plaintiff's exhibit number 1?

A. I think I do.

Q. By reference to plaintiff's exhibit 1-B, would you describe the device shown in Figure 3 of plaintiff's exhibit 1-B?

A. Well, the device will be referred to as a solenoid operated valve, in that the condition of the valve either opened or closed is dependent upon the energization of a coil which we commonly refer to as a solenoid.

Q. And in the drawing on exhibit 1-B is that solenoid colored?

A. The coil is colored red and it is identified by the number 30.

Q. Would you continue with your answer, please?

A. Yes. Now the valve is placed in a line for controlling fluid. For that purpose, you will note that on the ends of the device there are nipple portions, threaded portions at the [24] upper end, number 2, and at the lower end, number 11. Now that is for coupling the device in the line in which the flow is to be controlled.

These nipple elements, 2 and 11, are especially formed here to provide a flange portion, upper flange portion 6 and a lower flange portion 18.

Also integrally formed with that what you might call a pipe coupling are these ring-shaped portions 7 and 9. Now I think it is rather important to note that both of them — I am not stressing just one, but both of them — extend inwardly into the confines of the coil 30. Now that is so designated by the green up at the top and the blue at the bottom.

Now spacing these two elements is this yellow element shown in rectangular form which is actually a cylinder. Now that cylinder is of non-magnetic material. The other parts I have mentioned, with the exception of the coil which, of course, is wound copper usually, is of magnetizable material.

Q. Would you designate, Dr. Mauritz, by calling out the numbers of the parts which are made of magnetizable material?

A. The parts made of magnetizable material which I described are what is referred to in the specification as the inlet member, number 1. You will see that that has the flange portion and this inner ring portion, and also the outer nipple portion. That is all of magnetizable material. And similarly [25] at the lower end the outlet member 10 and its flange portion 18 and its ring-

shaped portion. The part that extends within the coil 9 is also of magnetizable material.

Now there is a jacket, an outer jacket member which encircles the flange portions 6 and 18. And that jacket is designated by the number 32. As I say, it is also of magnetizable material.

Now mounted and closely fitted into this ring-shaped portion 9, which is the lower blue portion, is an armature, sometimes referred to as a plunger, the plunger being number 19.

Q. What color is it in the drawing?

A. The color is purple.

Now this plunger 19 makes a close, sliding fit with this ring-shaped portion 9. And we also referred to that ring-shaped portion 9 as a pole piece, for reasons which we will make more clear later.

Now the other inner extending ring-shaped portion 7, which is the green portion, is also referred to as a pole piece; and it serves the function of a stop member for limiting movement of the plunger 19.

Now the plunger 19 is urged, constantly urged, by a small coil compression spring 25 into engagement with a valve seat. Now the valve seat being the lower portion and it is designated by the number 15. It is rather important to note [26] that this plunger 19 is formed at its lower end as a valve element, and the end of that valve element is entirely outside of the confines of the coil.

And also of importance is that the valve seat 15 is of non-magnetizable material. Actually it is a Teflon insert.

And you will note also that this plunger 19 has a hole extending actually through it in the form of a bore hole;

and also the stop member, the upper stop member, has a bore hold through it, so as to permit the flow of fluid through the valve.

Q. Axially?

A. Axially through the valve when the combination plunger and valve element 19 is raised from its seat 15.

Now this valve element is normally closed, what we call normally closed, in that the spring 25 constantly urges it, urges the plunger, the combination plunger and valve member, against the seat. Now it is moved away from its seat by energization, by applying current to the coil 30.

Now when the current is applied to the coil 30 there is a magnetic field established by the coil as a result of its current. Now this magnetic flux, the magnetism produced by the coil, is directed in a particular, unique path. And I believe this could be best exemplified by this sketch which was just handed to me. [27]

Mr. Kendrick: Would you mark this as plaintiff's exhibit 1-A?

The Deputy Clerk: Plaintiff's Exhibit 1-A is marked for identification.

(Plaintiff's Exhibit No. 1-A was marked for identification)

By Mr. Kendrick:

Q. And inviting your attention to exhibit 1-A, would you tell the Court, please, where the force generated by this coil is concentrated in the device shown in plaintiff's exhibit 1-A and 1-B, 1-B being the patent drawing and 1-A being the drawing showing the magnetic line of force?

A. Well, it is concentrated in the center of the coil, and this being assured by these two old pieces, 8 and 9,

which extend inwardly from opposite ends of the coil. And that establishes a strong field between the elements which are the green and the purple elements.

Q. In Figure 3 on plaintiff's exhibit 1-B?

A. Yes. And this is also indicated in plaintiff's exhibit 1-A.

Q. Now inviting your attention to both plaintiff's exhibits, Figure 3 in 1-B, and 1-A, would you tell the Court, please, the number of air gaps, if any, which appear there? And would you explain to the Court, please, what you mean by an air [28] gap in a device of this kind?

A. Well, the word "air gap" is more or less self-explanatory in that it designates an air space between two elements. In this arrangement there is only one air gap.

Q. For the record, you are referring to plaintiff's exhibit 1-B, is that correct? The exhibit number is at the top of the exhibit.

A. Yes, I am referring to Exhibit 1-B.

Now that air gap is between the green and purple elements. And to assure the existence of only one air gap there is a close sliding fit between the purple and blue elements.

Q. Is there any air gap between the valve plunger and the valve seat in plaintiff's exhibit 1-B?

A. No, there is not.

May I qualify it?

Q. Yes.

A. I said no because that part is outside of the magnetic field.

Q. You used the term air gap to mean a space that across which a magnetic current will flow?

A. I see where my prior definition on the air gap was rather specific to the presence of an air space. But magnetically speaking the effect of an air gap can be obtained by filling [29] which would otherwise be an air space with material which is not magnetizable, a material such as copper or aluminum, which does not increase the flux over and above that which would exist in the air in the absence of that material.

Q. All right. Now in plaintiff's exhibit 1-A, does that also illustrate the arrangement of parts that are found in plaintiff's exhibit 1-B, about which you have just testified?

A. I would say it is very representative of it.

Q. It includes all the parts about which you have just testified, namely, the coil, the armature, the pole pieces extending in the coil and the non-magnetic member?

A. Yes, you could make it up. It could be more clearly drawn, but I am sure someone could make it out.

Q. Would you indicate on plaintiff's exhibit 1-A the member that is supposed to represent a non-magnetic portion by putting an arrow in the sketch to the part you call non-magnetic?

A. All right. I will write down non-magnetic and then I will draw an arrow extending to that member which is non-magnetic.

Q. And would you also indicate the air gap in exhibit 1-A?

A. I will designate on here air gap and designate that space between two arrows and draw a line from those two [30] arrows down to the caption air gap.

which extend inwardly from opposite ends of the coil. And that establishes a strong field between the elements which are the green and the purple elements.

Q. In Figure 3 on plaintiff's exhibit 1-B?

A. Yes. And this is also indicated in plaintiff's exhibit 1-A.

Q. Now inviting your attention to both plaintiff's exhibits, Figure 3 in 1-B, and 1-A, would you tell the Court, please, the number of air gaps, if any, which appear there? And would you explain to the Court, please, what you mean by an air [28] gap in a device of this kind?

A. Well, the word "air gap" is more or less self-explanatory in that it designates an air space between two elements. In this arrangement there is only one air gap.

Q. For the record, you are referring to plaintiff's exhibit 1-B, is that correct? The exhibit number is at the top of the exhibit.

A. Yes, I am referring to Exhibit 1-B.

Now that air gap is between the green and purple elements. And to assure the existence of only one air gap there is a close sliding fit between the purple and blue elements.

Q. Is there any air gap between the valve plunger and the valve seat in plaintiff's exhibit 1-B?

A. No, there is not.

May I qualify it?

Q. Yes.

A. I said no because that part is outside of the magnetic field.

Q. You used the term air gap to mean a space that across which a magnetic current will flow?

A. I see where my prior definition on the air gap was rather specific to the presence of an air space. But magnetically speaking the effect of an air gap can be obtained by filling [29] which would otherwise be an air space with material which is not magnetizable, a material such as copper or aluminum, which does not increase the flux over and above that which would exist in the air in the absence of that material.

Q. All right. Now in plaintiff's exhibit 1-A, does that also illustrate the arrangement of parts that are found in plaintiff's exhibit 1-B, about which you have just testified?

A. I would say it is very representative of it.

Q. It includes all the parts about which you have just testified, namely, the coil, the armature, the pole pieces extending in the coil and the non-magnetic member?

A. Yes, you could make it up. It could be more clearly drawn, but I am sure someone could make it out.

Q. Would you indicate on plaintiff's exhibit 1-A the member that is supposed to represent a non-magnetic portion by putting an arrow in the sketch to the part you call non-magnetic?

A. All right. I will write down non-magnetic and then I will draw an arrow extending to that member which is non-magnetic.

Q. And would you also indicate the air gap in exhibit 1-A?

A. I will designate on here air gap and designate that space between two arrows and draw a line from those two [30] arrows down to the caption air gap.

The Court: I don't believe that counsel for the defense is going to object to any of the truth as to what this witness is saying. He is just describing a device, isn't he?

Mr. Cochran: Yes, sir. I don't see anything objectionable about it.

The Court: All right, go ahead.

By Mr. Kendrick:

Q. Would you describe, please, the shape of the member that you have referred to as an armature in plaintiff's exhibit 1-A?

A. Yes. The armature or plunger 19 in Figure 3 on exhibit 1-B is cylindrical, modified however by some machining operations to provide a central bore which doesn't extend completely through the plunger but which is intersected by angularly disposed bores at the lower end. And also this plunger is internally shouldered up at the upper end to provide a seat for the spring 25.

Q. Now is the armature mounted in a round member?

A. Yes. And it is closely fitted within this rounded member 9 which is a pole piece.

Q. Now is there any air gap between the armature and the member which you have designated as a pole piece? [31]

A. No.

Q. Now inviting your attention to claim 7 of the patent in suit, which is —

The Court: Of the application in suit?

Mr. Kendrick: Thank you, Your Honor.

By Mr. Kendrick:

Q. Inviting your attention to claim 7 of the application in suit — and this is the claim that we set forth on

page 3 of our pre-trial statement — and turning to the application, plaintiff's exhibit 1, would you compare claim 7, please, with plaintiff's exhibit 1-B, and tell the Court whether or not the elements which you have just described are called for in claim 7?

A. Counsel, would you want me to look through the file for claim 7 here or should I use a clean copy of it which appears in the brief?

Q. Well, let's find it in the actual Patent Office papers. I will give you the claim 7. It is reproduced in the brief.

The Court: There is no question, is there, Mr. Cochran?

Mr. Cochran: It is perfectly all right to go ahead with the one in the trial brief. I compared them earlier, Your Honor, and I believe it is accurate. [32]

By Mr. Kendrick:

Q. With that stipulation, would you compare it to claim 7 and use the example that is set forth in the trial brief?

A. Now the question again, sir?

Q. The drawing, 1-B.

A. Now the question is?

Q. Would you point out in the claims where the elements are called for as found in the drawing, Figure 3 of plaintiff's exhibit 1-B?

A. Yes, 1-B, boy?

Q. Yes.

A. All right.

Claim Number 7. In a solenoid type actuator, a spool-like coil holding element . . . Now that element as defined is defined by the flanges on the inlet and outlet members 1 and 10; and also by the inwardly directed pole pieces 7 and 9.

Continuing with the claim, it calls for "a solenoid coil mounted on said element." In this case the solenoid coil is the coil 30.

Q. The red coil?

A. That is correct. "Said coil-holding element comprising a first end member." Now the first end member is the upper member of the inlet member 1. And it is formed of paramagnetic [33] material. And the term "paramagnetic" has reference to the fact that it is a magnetizable material, as distinct, for example, from copper, which is not magnetizable. It performs as if air were there with respect to the effect produced by a magnetic field.

Now this first end member includes a portion extending into one end of said coil and serving as a fixed pole. The portion referred to here, as I referred to previously, is the pole piece 9 and it extends into one end of the coil and it serves as a fixed pole.

Q. That is colored green?

A. That is colored green.

Continuing, "said first end member having a coil engaging flange." In this case the flange is the element 6.

Continuing, "a second end member," the second end member being the lower element in figure 3 designated in the specification as the outlet member 10. And it is also formed of paramagnetic or magnetizable material, and it also includes a portion 9 in the form of a pole piece extending into the opposite end of the coil, the red coil.

Then there is a second end member 10 having a coil engaging flange. The flange being the portion 18.

Now the adjacent ends of said members — the members referred to being the inlet and outlet members

1 and 10 — [34] within said coil being spaced from each other.

In other words, that is saying that the inner pole piece portions, 7 and 9, are both within the coil and spaced from each other within the coil.

Continuing, the claim calls for "an element of paramagnetic material disposed exteriorly of said coil and interconnecting said flanges." The element in this case referred to is the jacket 32 which encircles and is affixed to the flanges by a series of screws 33.

Continuing, the claim calls for "a bore extending axially of said second end member from the end thereof within said coil towards the opposite end of said member." Now the second end member, as we defined it, was the outlet member 10, and it is shown in the drawing as a bore extending axially within the coil. Actually, the bore being defined by the angular surrounding portion of the pole pieces 9.

And continuing, the claim calls for "a nonmagnetic sleeve centrally disposed within said coil." The sleeve referred to is the sleeve 8 which is colored yellow and which is of nonmagnetic or nonmagnetizable material.

Continuing, the claim calls for "said sleeve having one end thereof engaging the end of said second member within said coil, the opposite end of said sleeve engaging the end of the portion of said first member within said coil." So I [35] think this is rather clear from the drawing. The ends of that sleeve 8 abut the green and yellow elements which, respectively, the first and second mentioned members.

Continuing with the claim, it cites "opposite ends of said sleeve being united to the end portions of said first and second members with resultant formation of said

spool-like element." Well, the specification, the fabrication, these ends are joined and you will see that the sleeve does close the space and the sleeve actually serves at least part of the coil.

"A paramagnetic armature slidably mounted in and closely engaging the wall of said bore." The paramagnetic armature is the plunger, also referred to before as the armature 19, and it closely engages the pole piece 9.

"Said plunger" — talking about the plunger 19 — "in the de-energized condition of said coil" — that is when no current is applied to the coil — "being spaced from said portion of said first end member." Well, that condition is illustrated in Figure 3 where the green and the purple elements are separated. And the separation defines a working gap as set forth in the claim "between said fixed pole 7 and the adjacent end" of the plunger 9.

The Court: Is your direct examination going to take much longer?

Mr. Kendrick: Yes, Your Honor. [36] The Court: Very well. This is the time for the usual afternoon recess. Court will now recess until 3:30.

The Deputy Marshal: This Honorable Court stands recessed until 3:30.

(Whereupon, at 3:15 p.m. the Court recessed as noted and reconvened at 3:30 p.m.)

The Court: Mr. Kendrick, as I see it, there is no quarrel between you and the Patent Office with respect to the sufficiency of your application, or that everything is just as it should be with respect to the claims. It is merely that your device is not patentable over the prior art. Isn't that correct?

Mr. Cochran: That is the only issue, Your Honor.

The Court: Well, I don't see the reason for all this testimony that has been going in for the last half hour.

I think if there was anything wrong with your specification or your drawings or anything of the kind the Patent Office would bring it up. What is the purpose of all this?

Mr. Kendrick: If Your Honor please, the purpose is this: This drawing now is duplicated about ten times, the Patent Office drawing. Then we are just going to show —

The Court: There is no quarrel about the drawing, is there?

Mr. Kendrick: If Your Honor please, we are going to [37] show commercial success and filling a long-felt want.

The Court: You are not doing it by this type of examination though.

Mr. Kendrick: I want to show that the thing that is claimed has gone into commercial success.

The Court: Ask him. Why don't you ask him then?

Now commercial success is never considered unless there is doubt, you know, with respect to the outcome.

By Mr. Kendrick:

Q. Mr. Mauritz, is it a fact that the elements shown in claim 7 are found in plaintiff's exhibit 1-B?

A. Definitely.

Mr. Kendrick: If Your Honor please, we would like to offer plaintiff's exhibits 1-A and 1-B in evidence.

Mr. Cochran: No objection, Your Honor.

The Court: I don't think they are very material but go ahead. Mark them in evidence.

The Deputy Clerk: Plaintiff's Exhibits 1-A and 1-B are marked in evidence.

(Plaintiff's Exhibits No's. 1-A and 1-B were received in evidence.)

(Mr. Kendrick conferred with the Deputy Clerk briefly and a series of plaintiff's exhibits were marked for identification.) [38]

By Mr. Kendrick:

Q. Inviting your attention to plaintiff's exhibits 2 and 4 —

The Court: For identification?

Mr. Kendrick: For identification, Your Honor.

By Mr. Kendrick:

Q. Have you compared claim 7 with the device shown on plaintiff's exhibits 2 and 4?

A. Yes. And I find that the claim is fairly readable on the structure disclosed in plaintiff's exhibit 2. And likewise I find the same to be true, namely claim 7 fairly is readable on the structure disclosed in plaintiff's exhibit 4.

Q. Thank you. Now inviting your attention to the Government's exhibit A, which is a collection of patents—

The Court: Government's exhibit 1.

Mr. Kendrick: Excuse me, Your Honor. I thought the Government used letters and the plaintiff numerals.

The Court: No.

By Mr. Kendrick:

Q. Inviting your attention to the Government's exhibit 1 —

Mr. Kendrick: May we have the Government's Exhibit Number 1?

The Court: Here, take this (indicating).

By Mr. Kendrick: [39]

Q. Inviting your attention, please, to the Government's Exhibit 1, and more particularly to the Gachon patent at paper D therein, have you studied the Gachon patent and the drawing thereof, Mr. Mauritz?

A. Yes. I have very carefully studied the disclosure in this French patent. Is that the one you are referring to, 876,454?

Q. Yes.

A. And not only the French wording of it as printed but also in relationship to the translation prepared by the United States Patent Office translator, J. C. Levy, dated 8-13-58.

The Court: Are you questioning that translation?

The Witness: No, sir.

The Court: All right.

The Witness: I just wanted to assure Your Honor that I have considered the translation as well as the French wording, having relied on my four years of high school French to do so.

Mr. Kendrick: I believe we have a stipulation from the Government that they are only contending that this reference is applicable under Section 35, 103. They do not contend the reference shows the device called for by the claims.

The Court: Why of course not. He has shown the likeness and the difference in his statement there.

Mr. Kendrick: Yes. He contends that it would be [40] obvious to one skilled in the art to make changes in the French patent —

The Court: Yes.

Mr. Kendrick: Thank you, Your Honor.

By Mr. Kendrick:

Q. Dr. Mauritz, would you please compare for us the elements called for in claim 7 —

The Court: Why don't you say in the application and be through with it, anywhere in the application?

By Mr. Kendrick:

Q. Would you compare the claims of the application, please, and as an example claim 7 of the application, with the Gachon patent and tell us whether or not it would be obvious to one skilled in the art to build the applicant's device from the Gachon reference?

A. Well, in trying to answer the first part of your question, I find it very difficult to apply the language of the subject matter here to the Gachon disclosure because of its nebulousness and indefiniteness, and particularly its failure to recite particular materials; and particularly whether a material is magnetic or nonmagnetic. By that I mean magnetizable or nonmagnetizable. In fact, he does not indicate any of his materials as being in either one of those categories. So it is entirely in one's imagination as to what [41] material it actually is, that is whether it is magnetizable or nonmagnetizable. However, to make it operative the only requirement is that — and this is not disclosed in the Gachon patent — the only element that need be magnetizable is his plunger 17; and it is possible to operate the Gachon system with the other elements being of nonmagnetic material; all of them or some of them.

Q. Now, does the Gachon patent disclose a single air gap as called for by claim 7 in Eckel's application?

A. There again, the very nature of this disclosure, which is very sketchy to say the least, we can't say truthfully because we don't know the shapes, particularly of the plunger 17. Now it might be round, it might be square, and it might be hexagonal. I say that because the solenoid art is at least sixty years old and it abounds in all types of cross-sections of plungers or armatures. And there is no indication of any snug fit between the armature and any member which might be considered to be a pole piece.

Q. And it is a fact, is it not, that if the assumption were made that the outer casing was of magnetic material the valve seat itself would set up an air gap and there would be a magnetic action at that point as well?

A. Yes, sir. There is a very interesting part about this construction, in that contrary to Mr. Eckel's valve you will [42] note, respectfully, that the valve seat and that end of the plunger which acts as a valve element, those two cooperating parts, are each within the confines of the coil and thus are subjected to a magnetic field. And if these two elements were of magnetic material difficulties could arise. Let me just amplify that a little bit. Because then you are not working with one air gap but you are working with two air gaps during the operation of the valve.

Q. And it is a fact, is it not, that the Gachon patent makes no differentiation in the materials used in the valve and the valve seat and the outside case? Is that correct?

A. That is right. The disclosure is silent as to the materials.

Q. All right.

A. Let me just amplify that. And the only safe test of a material — we might put it that way — to make it operate is that the plunger 17 be of magnetizable material. And the other, as I have indicated before, the other elements actually could be magnetizable or non-magnetizable material and yet achieve operation of the solenoid.

Q. Based on all of your experience of studying patents and your work in getting your doctorate at Johns Hopkins, and your work at G.E., as a result of your careful reading of the Gachon patent, could you state that it would be obvious to one [43] skilled in the art to

make the several modifications that need be made to make the combination of elements called for by claim 7 of the patent?

A. It certainly would not be obvious to me that someone could just take this disclosure and come up and produce the Eckel valve with all of its beneficial results.

Q. You have testified that the Gachon patent shows a space between the armature and the bore, you have shown that it shows two magnetic portions, and so now that could be referred to as three air gaps, could it not?

A. Yes, if you consider — And here, again, it is a little difficult to describe these elements. Some of them do not even have a reference number, they are just there. There is a gap between the plunger and — Let's see if I can identify this element, 20, and as mentioned previously, during operation of the valve there is a gap between the valve end of the plunger and its seat 7; and depending upon the cross-sectional area of the plunger itself there is a good possibility that there is another air gap there, or at least there is not a good close fit.

Q. Now you have testified that in this art it is conventional to have armatures that are of a different shape than the chamber in which they reciprocate, so that they do have air gaps. I will invite your attention to the plaintiff's [44] exhibits 8-A, B, C, D and E, and I will ask you whether or not these patents disclose structures of the kind to which you have just referred; namely, an air gap between the armature and the holding?

A. Well, referring to plaintiff's exhibit 8-A, which is the Hoppe patent 2,084,030, it illustrates for our testimony that there shown at 19 is a square armature or plunger.

In plaintiff's exhibit B —

The Court: In plaintiff's exhibit B?

The Witness: Plaintiff's exhibit 8-B. I am sorry, sir. I haven't studied this one yet, counsel. It was just handed to me. But I have got others here that I can refer to. I am sorry, I haven't seen these disclosures at all.

The Court: We are not going to finish today, so you can study them this evening if you care to.

The Witness: Thank you, sir.

By Mr. Kendrick:

Q. Well, inviting your attention to 8-D and to Figure 4 —

The Court: Have you seen these, Mr. Cochran?

Mr. Cochran: No, I haven't seen these, Your Honor.

Mr. Kendrick: I marked them during the recess, Your Honor.

The Court: You should always, when you are tendering an exhibit, hand it to your adversary and have him look at it [45] because he might want to object to it.

Mr. Kendrick: We marked them during the recess, Your Honor.

The Witness: Referring to plaintiff's exhibit 8-D —

The Court: One minute. Don't testify anymore.

Mr. Cochran: Your Honor, I would have to have time to look at these to see just what they show and what they are being offered for.

The Court: Yes, and I think the witness needs time to look at them also. It is pretty close to adjournment time, it is just thirteen minutes away, so Court will now stand adjourned until tomorrow morning at 10:00 o'clock.

The Deputy Marshal: This Honorable Court stands adjourned until 10:00 o'clock tomorrow morning.

(Whereupon, at 3:50 p.m. the Court adjourned as noted. [46])

PROCEEDINGS

Friday, April 17, 1964.
10:00 a.m.

The Court: The witness will resume the stand. He has already been sworn.

Thereupon —

MR. FRANK EDWARD MAURITZ,
a witness called by and on behalf of the plaintiff, resumed the stand and, having been previously duly sworn, was examined and testified further as follows:

Mr. Kendrick: If Your Honor please, we stayed after Court last night and marked the exhibits and we met this morning and got an agreement on introducing most of them in order to save a lot of time.

The Court: Well put them in in proper order the way they ought to go in.

Mr. Kendrick: All right, Your Honor.

Exhibit 2, a blue print, has been marked for identification. Exhibit 4, a blue print has been marked for identification. Exhibits 3, 3-A, 3-B, 3-C, 5 and 5-A, Eckel Valves, have been marked for identification. Exhibit 6, an Eckel Valve has —

The Court: Has any witness been examined on any of these things, or are these things being put in in advance?

Mr. Kendrick: These are being put in in advance.
[47]

The Court: I don't want it that way. I told you to put them in in the proper order. When you want to examine a witness on any of those things present it to him, ask him what it is and be sure to refer to it by the proper number for identification. According to you,

there will be no objection because you have stipulated as to these, but I will ask counsel for the defendant at the proper time.

Mr. Kendrick: All right, Your Honor.

The Court: Get them in in proper order.

By Mr. Kendrick:

Q. Dr. Mauritz, the Patent Office has taken the position that the Gachon patent teaches one skilled in the art to build the casing of Gachon of magnetic material. I will invite your attention to plaintiff's exhibit 8 for identification, which is an enlargement of the Gachon drawing, and would you tell the Court —

The Court: That is more than that, isn't it, or is that a separate exhibit over on the other side of the board?

Mr. Kendrick: That is a separate exhibit over on the other side.

The Court: All right.

By Mr. Kendrick:

Q. Would you tell the Court whether or not there is any teaching in Gachon of making the casing member that has been [48] colored red of a magnetizable material as called for by the claims in the application that are in issue before this Court?

A. There is no teaching that such casing should be—

The Court: How is that valve motivated, manually, or by steam, or air, or what?

The Witness: It is electrically magnetically operated by energizing the coil 16.

The Court: One minute now. Magnetizing what?

The Witness: May I step over to the board, sir?

The Court: Why of course.

The Witness: This exhibit 8 represents a portion of the single figure of the French drawing, and it is the

electromagnetic part which is designated by the numeral 16.

The Court: Now what electrifies it? Point it out. Is it the pink portion that is magnetized or what?

The Witness: The white portion here (indicating).

The Court: Which is the white portion?

The Witness: The white portion 16.

The Court: That is the body, is it, that has a cross in it?

The Witness: That, sir, is the coil.

The Court: Those are two coils, electrical coils?

The Witness: Presumably it is a single coil, sir, as I visualize it. [49]

The Court: I see, it is circular.

The Witness: It is circular.

The Court: That is just a cross section.

The Witness: When current is applied to this coil here the purple portion is moved upwardly, and when it does this valve designated by the number 7 moves from its seat, the seat being 18.

The Court: Does it open or close the valve?

The Witness: On applying current to the coil 16 this valve 7, 18 is open.

The Court: I see. How does that differ from what you have there on that other exhibit?

The Witness: Well, it differs —

The Court: How does it differ from the device of the application?

The Witness: Well, the device of the application has the magnetic body, all of this red portion here in exhibit 20 —

The Court: For identification. Or is that in evidence?

Mr. Kendrick: It is not in evidence as plaintiff's exhibit 20, but it is in evidence at paper F in the Patent Office exhibit 1, Your Honor.

The Court: All right.

The Witness: It is of magnetizable material. All of [50] this part which is colored in red is of magnetizable material.

The Court: That is the same thing as in the other exhibit that you just talked about, isn't it?

The Witness: No, sir.

The Court: What is magnetized in the other, isn't the coil?

The Witness: The current is supplied, sir, to the coil, and it sets up a magnetic field. And the magnetic field causes this purple element, which is a armature core, and a valve element to move against the action of this spring.

The Court: Of a spring?

The Witness: Yes, sir, 19.

The Court: Isn't that exactly what happens over here in your device too?

The Witness: Overall, yes.

The Court: All right.

By Mr. Kendrick:

Q. Would you point out to the Court that the material that is colored purple in plaintiff's exhibit 8 is magnetizable, and the material that is colored red which I am now putting blue x's on indicates that it is made of the same material as the armature is over here?

A. That is true. In exhibit 20 these elements here are all of magnetizable material. The French patent, Gachon patent, [51] doesn't mention which materials are magnetic or nonmagnetic.

The Court: Are the materials themselves mentioned?

The Witness: I beg your pardon, sir.

The Court: Are the materials themselves?

The Witness: No, sir.

The Court: They are not?

The Witness: No, sir.

The Court: You don't know whether it is wood or steel?

The Witness: No, sir. That is correct.

By Mr. Kendrick:

Q. Could the casing in Gachon be made of wood?

A. Yes, it could.

Q. Now you have pointed out that in Gachon that this material in the valve is of nonmagnetic material as distinguished from magnetic material in the Eckel device, would you tell the Court, inasmuch as there is no disclosure in the French patent, why you draw the conclusion that the pink member on plaintiff's exhibit 8, namely the casing, in Gachon is made of nonmagnetic material as distinguished from the casing in the Eckel valve being made of magnetic material?

A. The casing you referred to is designated by the reference numeral 2 in the Gachon patent and the —

Q. Where is the 2? Where is it shown on here?
[52]

A. It doesn't show on here. We can refer to it as 5. It is 5 on plaintiff's exhibit 8.

The Court: That is the casing of the coil, isn't it?

The Witness: Yes, sir.

The Court: You say it is nonmagnetic, or you don't know?

The Witness: I would say it would be contrary to good engineering practice to make it of magnetizable material.

The Court: How about in your own device, isn't that magnetizable?

The Witness: well, there is a different structure here, sir.

The Court: I see.

By Mr. Kendrick:

Q. Would you explain why it would be contrary to good engineering practice in the combination of parts shown in Gachon to make the casing 5, the red portions here, of magnetic material? What would happen in the operation of the Gachon structure if it were made of magnetic material?

A. Well, when you energize the coil 16 it sets up a magnetic flux.

The Court: In other words, that is insulated by the pink matter, isn't it? That pink matter is a shell?

The Witness: Yes, sir. This part here, we see a [53] cross here (indicating), and this rectangular portion here I assume —

The Court: That is a coil, isn't it?

The Witness: Yes, sir. And that is conventional, you usually wrap it with tape and insulate it.

By Mr. Kendrick:

Q. Would you tell the Court, please, why the pink member in Gachon should not be made of magnetic material and the difference in the arrangement of parts that permit the shell to be made of magnetic material in the Eckel device?

A. Well, if this part 5 in Gachon were made of magnetizable material a person would be setting up oppositely active forces, one of which acts in the direction to defeat the purpose he is trying to accomplish. Now I will be a little more specific about that and show

you just why that is. If this coil is energized here (indicating) there is magnetic flux coming down through here. And assume if it comes down here (indicating) there will be a north pole formed up here.

The Court: It is a positive there?

The Witness: Yes, sir. We usually refer to it as a north pole. And a south pole down here (indicating).

By Mr. Kendrick:

Q. By down here, for the record, do you mean the armature would be the south pole? [54]

A. Yes, sir. The top part of the armature core, which is purple, would be a south pole. The adjacent end —

The Court: Surrounding the spring?

The Witness: Surrounding the spring and designated by the number 20 is a north pole under these conditions where the flux is coming down in this direction. And likewise, at the lower end of this purple element there is a north pole, and below that the valve seat, which is designated as 7, would be a south pole. Now we see the overall pattern. We have a north pole — south pole, a north pole and a south pole. Now we all know that a north pole attracts a south pole. So there is a force developed between the upper end of the core member and this upper member here (indicating); and also a force is developed at the other end of the core member and the valve seat 7.

By Mr. Kendrick:

Q. Now would that force develop at 7 if the material were made of nonmagnetic material?

A. No, it wouldn't.

Q. But if the material were made magnetic, the pink material in Gachon were made magnetic then there

would be an attraction between the valve seat and the armature?

A. That is correct.

Q. And that would be working in opposition to the matter tending to be unseated by the magnetic force at the top of [55] the armature shown in plaintiff's exhibit 8 and the magnetic field set up by the coil?

A. That is correct.

Mr. Kendrick: Now in claims 9 and 11, Your Honor, we specify that this armature valve seat is outside the coil, as you will notice down here (indicating), so that there is no magnetic force —

The Court: Well, your drawing shows that. There is no dispute about that.

Mr. Kendrick: That is right.

By Mr. Kendrick:

Q. Now I invite your attention to element 15 in the Gachon patent, which, in the translation, says that there is a magnetic surface surrounding the coil. Will a dotted line showing a magnetic line of force tell you the nature of the material?

A. No, sir.

Q. And is Roters one of the known texts on the subject of magnetic material?

A. It has a very good reputation.

Q. And —

The Court: It is generally known by everybody in the art what magnetic material is.

Mr. Kendrick: Our point is, Your Honor, there is no [56] disclosure at all in Gachon of the nature of the material. All he shows is a coil with magnetic lines around it. And if he used a magnetic shell then his valve would be inoperative. Yesterday Dr. Mauritz testified

that these shells can be made of all kinds of material, that it is not necessary that any of the parts be made of any kind of material, but it was in the selection of a number of parts and arranging them in a very special way and making them of a special material. In magnetic work you must disclose the material by name or no one will know what its properties are. Now in the French patent there is no mention of what this outer shell is made of.

The Court: I understood from your opening statement that everything in your device is old, but invention consists in coupling these things to get a surprising and unexpected result.

Mr. Kendrick: That is right.

The Court: All right. Then why go through all this then if it is all old?

Mr. Kendrick: There is no showing of an arrangement of parts in our material because Gachon is a different type of device entirely.

The Court: I know.

Mr. Kendrick: Thank you.

By Mr. Kendrick: [57]

Q. Now the Patent Office stated that it would be obvious to make the parts of the material that Eckel has selected. Is that statement true?

A. I don't understand your question, sir.

Q. Well, the Patent Office has stated that it would be obvious to one skilled in the art to make, for example, the T-shaped member in Gachon of a nonmagnetic material. Is that true?

A. No, sir.

Q. It is a fact, is it not, that Gachon would be operative whether it was with nonmagnetic material, and

it would be contra to the teachings thereof to make the outer shell of magnetic material, isn't that correct, as you have testified?

A. That is right.

Q. Now, it is a fact, is it not, that in Eckel —

Mr. Cochran: If Your Honor please, he has been leading the witness now for a whole series of questions. I think he could perhaps let the witness testify.

The Court: Don't lead the witness. Let the witness testify.

By Mr. Kendrick:

Q. Would you tell the Court, please, how many air gaps are in the Eckel device which is shown in plaintiff's exhibit 20? [58]

The Court: For identification.

Mr. Kendrick: For identification.

Mr. Cochran: I think this is material we went over yesterday. He spoke considerably of air gaps in the Eckel device and also, I believe, in the Gachon device.

The Court: I thought so too, but if you want to question him question him on it very briefly. I remember the testimony concerning air gaps. That is in the device in issue here, but I don't know about the other one, the French patent. Is that what you are talking about?

By Mr. Kendrick:

Q. In the Eckel device, would you tell the Court how many air gaps are found?

A. There is just one, the working air gap.

Q. And in the Gachon device would you point out to the Court the number of air gaps?

A. Well, to start off with there are two, the ones which I have designated here with respect to the letters

"N" and S" for north and south poles. There is an air gap during operation of the core.

The Court: Where is the other one?

The Witness: At the upper end and the other one is at the lower end as the core member separates from the valve seat. [59]

The Court: I see.

The Witness: Now it is not definite as to whether there is a third, and there is quite a suggestion that there is a third air gap in here because of the particular construction of this core member. The core member has a slot —

The Court: Do you mean in the drawing, do you, rather than the specification?

The Witness: That is correct, sir. In the drawing. The core member 17 has this L-shaped opening through it.

Mr. Kendrick: Would you hand His Honor the defendant's exhibit 1-D? It shows up plainly in that in the coloring.

The Deputy Clerk: I am sorry.

Mr. Kendrick: Exhibit 1-D. I believe Gachon is D.

The Court: This is the French patent, is it?

Mr. Kendrick: Yes, sir.

The Court: All right, I see it.

The Witness: I will color this opening green in plaintiff's exhibit 8. Now that indicates an air space between the core member and this member 5. And due to this particular construction there is a clear indication that Gachon was not concerned at all with getting a close fit.

The Court: Well, you say then that there are probably three air gaps?

The Witness: Yes, sir. Definitely two, probably [60] three.

By Mr. Kendrick:

Q. Would you just briefly point out to His Honor the close fit of the armature in plaintiff's exhibit 20, being a blowup of the drawing of the Eckel patent application?

A. The close fit in the Eckel valve is indicated at this reference numeral 19, which is between the core member, the moveable core member or armature, and the outlet member.

Q. Would you point out the numbers to the Court that support your testimony that the valve closing member is outside the confines of the coil in the Eckel device, and compare that with the position of the valve seat in the Gachon device?

A. Yes. In exhibit 20 the valve is entirely outside of the confines of the coil.

The Court: That is obvious from the comparison of the drawings.

The Witness: And another distinction here, sir, is that this valve seat is of Teflon material.

The Court: What?

The Witness: It is of Teflon, T-e-f-l-o-n, material, which is recognized as a nonmagnetic material. So for those two reasons there are no poles produced out here. First of all, the valve member is outside of the confines of the coil and —

The Court: And because of those differences which you [61] have testified to, you say it would not be obvious to anyone skilled in the art to so construct the French device so as to read on yours?

The Witness: That is correct.

By Mr. Kendrick:

Q. Now would you turn briefly to the Fuscaldo reference and tell the Court whether or not the Fuscaldo reference teaches the feature called for in the claims of the Eckel application requiring a nonmagnetic material to extend inside the coil and up to the air gap?

A. Well, it is clear from Figure 1 —

The Court: Which of the references did you mention?

Mr. Kendrick: Fuscaldo, F-u-s-c-a-l-d-o.

The Court: Oh, Fuscaldo. All right.

The Witness: Well, the first thing that is quite noticeable in Fuscaldo is that he uses a conventional long sleeve, guide sleeve 12, and that his pole pieces, he does not have two pole pieces which enter opposite ends of the coil —

By Mr. Kendrick:

Q. And extend —

A. And extend inwardly to define a short central working gap in the center of the coil.

Q. Now it is a fact, is it not, that in Fuscaldo there is — [62]

The Court: Don't lead the witness.

Mr. Kendrick: Strike that please.

The Court: Ask him what the difference is or what are you trying to get at, the conclusion.

By Mr. Kendrick:

Q. Would you tell the Court first whether or not there is any suggestion in Fuscaldo, or whether or not it would be obvious from Fuscaldo to modify the Gachon device to teach the Eckel device?

A. I see no suggestion whereby the inherent deficiencies in the Gachon patent may be procured.

Q. There is no suggestion in Gachon —

The Court: Don't lead the witness.

By Mr. Kendrick:

Q. You have testified that in Gachon there is no showing of a nonmagnetic material extending into the coil; is that correct?

A. That is correct.

Q. And is there any suggestion in Fuscaldo of a nonmagnetic material extending into the coil?

A. Not into both ends of the coil. There is a suggestion of just one but not both ends as called for by the Eckel device.

Q. And is there a centrally disposed air gap in Fuscaldo with — [63]

The Court: Is there an air gap in Fuscaldo?

The Witness: There is a working gap, sir, but it is away off at one end.

The Court: Is it an air gap?

The Witness: Well, there is a working gap; yes.

The Court: All right.

By Mr. Kendrick:

Q. Now does the Fuscaldo reference teach the use of a short nonmagnetic sleeve as called for in the claims of the Eckel application and as exemplified on plaintiff's exhibit 20?

A. On the contrary, Fuscaldo definitely teaches a long sleeve extending the full length of the coil.

Q. And based on your experience as a technical man, could you tell the Court whether or not that is a conventional type sleeve?

A. Yes, that is very conventional; thousands of them are built that way.

Mr. Kendrick: If Your Honor please, we would like to offer in evidence plaintiff's exhibits 8 and 20.

Mr. Cochran: No objection.

The Court: Under the stipulation they may be marked in evidence.

The Deputy Clerk: Plaintiff's Exhibits 8 and 20 are marked in evidence. [64]

(Plaintiff's Exhibits Nos. 8 and 20 were received in evidence.)

By Mr. Kendrick:

Q. Dr. Mauritz, you have testified that the line 15 in plaintiff's exhibit 8 showing a magnetic circuit would not disclose the nature of the outer shell; is that correct?

A. That is correct.

Q. And would you tell the Court, please, whether or not a magnetic circuit would pass through wood, ceramics, copper or iron?

A. Oh definitely. We don't know of any material through which a magnetic field would not pass.

Q. So the fact is that the magnetic line in the Gachon patent, as you have testified, would not teach the material; is that correct?

A. That is true.

Mr. Kendrick: Thank you.

We have no further questions, Your Honor.

The Court: Cross-examine, Mr. Cochran.

Have you other exhibits to come in through further witnesses?

Mr. Kendrick: Yes, sir.

The Court: All right. [65]

Cross-Examination

By Mr. Cochran:

Q. Dr. Mauritz, you have testified in a sweeping sort of way that Gachon is so indefinite that it would be unobvious to derive the claimed subject matter from that patent. And I have heard you mention three specific things, as I analyze your testimony, in support of that statement. First, that the patent is indefinite as to the nature of the materials which are used, whether they are magnetic or nonmagnetic. Secondly, that there were possible air gaps which would cut down on the efficiency of the device. And third, that the valve is inoperative.

A. Sir, I didn't testify the valve was inoperative.

Q. What was your testimony?

A. I —

The Court: I think his testimony was if it was magnetized as the device in issue is it would be inoperative. Is that it?

The Witness: No, sir. My testimony was that the development of these lower poles, these lower north and south poles in plaintiff's exhibit 8 causes a force to be developed which is in opposition to this useful force which you are trying to develop from the coil. So with Gachon's construction and with the assumption that the element 5 is of magnetic material you would be defeating your purpose. I wouldn't go so [66] far as to say it would be inoperative but it would be quite inefficient. In my opinion, a designer for one responsible for manufacturing these selenoids of this type would not use magnetic material here and develop this extra north and south pole which would be operating in a direction to defeat his purpose.

The Court: Well, there would be one opposing the other equal in strength and opposite in direction, is that it?

The Witness: Well, because of the areas here I wouldn't say it would be equal and opposite, but there would be definite force.

The Court: One opposing the other? Two forces one opposing the other?

The Witness: That is correct, sir.

The Court: All right.

By Mr. Cochran:

Q. Would there be a greater magnetic field developed here at the center of the coil (indicating), or here where the valve contacts the seat?

The Court: Assuming what?

Mr. Cochran: Assuming that the coil is energized and the casing and the parts colored red are made of iron.

The Witness: Well, because of the area here, sir, I would say the force would be greater here (indicating). [67]

By Mr. Cochran:

Q. Where is here?

A. Here would be up at the upper end of the core member.

Q. At the center of the coil?

A. Yes.

Q. Now do you think that a designer who ran into this problem of inefficiency because of the development of poles at the valve which would be in opposition to the development of the field at the center of the device, do you think he would find it unobvious to provide a nonmagnetic seat for the valve?

A. Well the suggestion certainly would be there to provide some kind of a means to —

Q. Well, answer the question.

A. Well, I am trying to, sir. It is a very broad question. He would try to provide some means for eliminating the development of these north and south counteracting poles.

Q. Would the use of some sort of magnetically insulating material at that point be obvious?

Mr. Kendrick: I am going to object to this because this is contra to the teaching of the Gachon patent.

The Court: This is proper cross-examination. Your objection is overruled.

The Witness: Sir, in the first place, he wouldn't make this thing of magnetic material to develop that problem. [68]

By Mr. Cochran:

Q. Well, we are assuming for the moment that the case is made of iron. My question is based on that assumption.

A. Well, in that case, if we are going to redesign it, I would move the whole thing out of the confines of the coil.

Q. Do you think that would be obvious?

A. No, sir. It would require —

The Court: Would it be obvious to put an insulator in there? That is the substance of your question, isn't it?

Mr. Cochran: Your Honor, we are getting some coaching from counsel here on this.

The Witness: I haven't heard it if there has been.

No, I don't think it would be obvious.

By Mr. Cochran:

Q. Would you say it was known in the art to magnetically insulate valve parts from armature parts in a solenoid operated valve?

A. Now you used the words "magnetically insulate", sir. I don't think the term is proper because —

Q. Let me reframe the question.

A. There is no such thing as a magnetically insulating material.

The Court: See if you can rephrase the question.

By Mr. Cochran: [69]

Q. Let me rephrase the question. Is it known in the art to use a magnetic material as part of an armature to connect it to a valve?

A. Oh, yes. I think that has been done in particular constructions.

Q. Fuscaldo shows this, does he not?

A. Yes, I think he does.

Q. What part is that?

A. Well, his move core member is —

Q. Number 5 is the armature, is it not?

A. That is correct. And there is a rod that is attached at 9. I am not sure whether that is of magnetizable material. It probably is, but I don't know. I would have to check that. And there the rod 9 is attached to the left-hand end, the left-hand end being shown up at figure 1-A, and it carries a moveable valve element 10. So in that case Fuscaldo what he did was to bring out a rod.

Q. All right. Let me refer you now to page 2 of the patent, column 1, beginning at line 38, where the statement is made:

"Moreover, as the hub 8 connecting the ring armature 5 to the stem 9 of the valve 10 is made of non-magnetic material, for example bronze, and, for reasons stated hereinafter, since the stem 9 and the spring 11 are of tempered steel, this will [70] prevent magnetic flux from dispersing in any great quantity in the stem and spring."

There the statement is made, is it not, that the hub 8 which connects the armature 5 to the valve stem is nonmagnetic; isn't that so?

A. It says it is of bronze, which is a non-magnetic material.

Q. How many of the claims in the application call for a valve?

A. Well, I would have to check that, sir.

Q. Actually only two of the claims do, do they not?

Mr. Kendrick: We will stipulate, Your Honor, that it is 9 and 11; and dependent claims thereon.

By Mr. Cochran:

Q. In Fuscaldo the valve member is outside the confines of the coil, is it not?

A. Yes, sir.

Q. Now you say that when a patent says that it provides a magnetic circuit that you cannot assume that the magnetic circuit is through magnetic members; is that your testimony?

A. Not precisely if I understand your question correctly. A line designating a magnetic circuit as such and nothing more does not identify the material, because a magnetism can flow through air. As a matter of fact, it can flow through [71] a vacuum. It can flow through magnetizable material and non-magnetizable

material. Just the fact that you have drawn a line indicating a magnetic circuit is no indication at all as to what the material is.

Q. Now Fuscaldo refers to a magnetic circuit, does he not?

A. I am reasonably sure that he does, sir.

Q. Are you familiar with the Fuscaldo patent?

A. Yes, sir.

Q. At the bottom of column 2 at page 1 reference is made to a magnetic circuit indicated in Figure 1-B by arrows 6, and that the fact that the only gap therein is in the axial end-clearance 7 between the fixed armature 4 and the moving armature 5. Now when he refers to a magnetic circuit there, is he —

A. Did you say it is a fixed armature and a moveable armature; is that what you said?

Q. Yes, a fixed armature 4 and a moving armature 5.

The Court: Where are you reading from on that patent?

Mr. Cochran: This is on page 1 at the bottom of column 2.

The Court: What line?

Mr. Cochran: Line 53.

The Court: All right. [72]

Mr. Cochran: (Reading) "The magnetic circuit is indicated in Figure 1-B by arrows 6."

By Mr. Cochran:

Q. Now is that magnetic circuit through magnetic parts?

A. It extends through magnetic parts and also extends through an air gap, a working air gap.

Q. That is right. But the only parts of the solenoid device which it extends through other than the air gap are magnetic, are they not? It doesn't extend into any non-magnetic parts, does it, as shown?

A. Well, the air gap, as I said, is non-magnetic. Air is not magnetic.

Q. I said, except for the air gap.

A. With that exception; yes, sir.

Q. It extends only through magnetic parts?

A. That is right.

Q. Now when you read a patent and it says a magnetic circuit is provided, and it shows definite lines for the magnetic circuit, wouldn't you assume the parts through which it passed were of magnetic material?

A. Not necessarily, sir. No, sir, I couldn't make that assumption. As a matter of fact, if I might say, at any time an inventor brings me a disclosure of a magnetic circuit the first question I ask him is: "What parts are of magnetic [73] material and what parts are not?"

Q. We are talking about a patent disclosure which shows a line that indicates a magnetic circuit.

A. Even though it has a line which purports to show a line where flux may flow. I know flux will flow through a vacuum, it will flow through air, it will flow through copper and magnetizable material. That in itself doesn't give me any information as to the nature of the material, because the same flux can flow through all these various materials.

Q. In the same amount?

A. Of course, we realize that magnetizable material has what we call a "B", the flux produced by the additional magnetism set up, for example, by a coil. And it is usually magnetized a little bit.

Q. Now in a device such as you described, where you have magnetism set up by the coil, and you have magnetic parts and non-magnetic parts associated with the coil, will not the flux be concentrated more in the magnetic parts than in the non-magnetic parts?

Mr. Kendrick: If Your Honor please, I think the cross-examination should be limited to the type of magnetic circuits shown in the Gachon patent.

The Court: Cross-examination is almost wide open. If it is an objection is is overruled. [74]

By Mr. Cochran:

Q. Would it not be concentrated more in the magnetic parts than in the non-magnetic parts?

A. I don't know what you mean by concentrated more. There is more "B" produced in a magnetizable material than would be in air.

Q. What do you mean by "B"? Is this a measure of some quantity?

A. Yes, it is the flux produced in the coil by — Or I should say it is the flux produced in the magnetizable material as a result of magnetism set up by a coil.

Q. So you would have more "B" then in the magnetic material than you would in the non-magnetic material?

A. That is right.

Q. Well, when you see a line in a patent representing a magnetic circuit and it flows through certain parts and avoids other parts, wouldn't it be a reasonable assumption that the parts through which the line passes are magnetic and those which it avoids are non-magnetic?

A. No, I wouldn't make that assumption.

Q. As a person skilled in the art and he wanted to take the maximum advantage of the magnetic field generated in the coil in Gachon, would he select materials which have a high magnetic permeability for the parts which are colored in red [75] in plaintiff's exhibit 8?

A. Well if he did, sir, he would have this problem which I mentioned in connection with the development of these counteracting poles. That is, if he made his casing 5 of magnetizable material he would be to a large extent defeating his purpose.

Q. Ignoring that effect and looking on the device only as an operator for some mechanism outside the solenoid device, would he choose materials which are colored in red which are magnetic?

A. If I understood your question, you are assuming a structure in which you, for example, attach a rod to the magnetizable core member in Gachon. You would have the same problem, because if I understand your question, you haven't taken this auxilliary north and south poles which is developed; you haven't done anything to disturb that.

Q. If we provide a non-magnetic seat for the valve 7 in the Gachon patent and you wanted to derive the maximum benefit from the field generated by this coil, would you make the parts shown in red of magnetic material?

A. I don't understand your question, sir.

Q. What about the question don't you understand?

A. You are making two assumptions, as I understand the question, and you propose to make the body 5 of magnetizable [76] material.

Q. No, I am asking you — Let me rephrase the question so you will understand it.

A. All right. •

Q. I am making two assumptions. First, you want to get the maximum benefit out of the magnetic field generated by this coil. And the second assumption is that we provide a non-magnetizable material for the seat for value 7. Would one skilled in the art make the parts colored in red in plaintiff's exhibit 8 of magnetic material?

A. Sir, you assume that to start with.

The Court: Assuming those things to be true, what is your answer?

The Witness: No, I don't think it would be obvious. It wouldn't be obvious.

By Mr. Cochran:

Q. You do not think it would be obvious?

A. No, sir.

Q. Why not?

A. Because you are still within the confines of the coil where the field is, the field intensity is quite high, and the magnetism coming through there would produce quite a force, still quite a force, which would counteract the force which you are trying to develop. [77]

Q. Where would this force be developed?

A. Well, the mere fact that you are still inside of the confines of the coil.

Q. What is within the confines of the coil? Now we are speaking for the record and the record is not going to show what you are pointing to.

A. Well, sir, your assumption was that you were not going to move this purple element to move the core member, if I understand your question. At the tip of

this core member at the valve seat you were going to put some material, non-magnetizable material, in here. Well, the answer to my question is that it is not going to help you too much because you have not moved the valve member. This area we are still talking about where you propose to add this non-magnetizable material is still within the axial limits, as I say, it is within the confines of the coil 16.

Q. All right let me put the question another way then.

Mr. Kendrick: Could we let the record show that all this testimony was relating to plaintiff's exhibit 8, Your Honor?

The Court: The record may so show.

The Witness: Regardless of how much you put down here, with this moveable armature within the confines of the coil there will still be a force developed at this lower end [78] of the core member which will be acting in an amount to defeat your purpose.

By Mr. Cochran:

Q. Let me ask you this then. Assuming that the armature member in Gachon, as shown in purple in exhibit 8, is used to operate in a valve outside of the confines of the solenoid, as shown in Fuscaldo, and that it is attached to the stem of the valve by a non-magnetic material, as shown by Fuscaldo; and assuming further that you want to gain the benefit, the maximum benefit, of the field generated by the coil in Gachon; would you make the casing shown in red, the parts shown in red, of magnetic material?

A. No, sir, I would not make them of magnetic material.

Q. Why not?

A. Because here, again, under your assumed conditions, you have not moved this moveable armature out of the confines of the coil.

Q. I said that the armature is attached to a stem by a non-magnetic material and that the valve is outside of the confines of the body of the solenoid.

A. The valve is but you still haven't relocated this element here (indicating).

Q. I see. So that you are saying if the armature remains within the confines of the coil you would not make the [79] parts shown in red of magnetic material; is that it?

A. Yes, because you would still have this air gap, the development of this north and south pole between this armature and this assumed magnetizable material.

Q. I tried to premise my question on the fact that you do not have a valve seat 7 within the confines of the coil. The valve is entirely outside of the coil. The armature is attached to a rod, as shown in Fuscald, by a non-magnetic material to operate a valve outside of the confines of the solenoid.

A. Under that condition you would not develop any poles here.

Q. Right. That is correct. Now, would under those conditions you make the casing and other parts shown in red in plaintiff's exhibit 8 of magnetic material?

A. Would I make it?

Q. Yes. Would one skilled in the art attempting to derive the —

Mr. Kendrick: Are you talking about the teaching of Gachon?

The Court: He is talking about the Gachon apparatus and his question assumes that you would put it into the device of this application. Is that correct?

Mr. Cochran: Yes, Your Honor. [80]

The Court: I see.

The Witness: If a person did that there would be one of eight different choices he could make. Now when we talk about making elements here of magnetizable material there are three different elements in here which could be either magnetizable material or non-magnetizable material. So you take three elements in all of their permissible combinations and you would end up with eight permissible combinations. Now you are asking me whether it is obvious. Since Gachon himself has indicated there is nothing critical about it, you are asking me whether it is obvious if one can choose one of those eight and get the Eckel device. Well, I say it is not obvious. I just say it is not obvious. If a person has eight choices and you are asking him to make one of them, I say that one choice is not obvious, particularly since Gachon himself indicated that there was nothing critical about it.

By Mr. Cochran:

Q. Does Gachon indicate there is nothing critical about the —

A. Well, the fact that he has not mentioned what his material was, whether it is magnetic or non-magnetic, that in itself indicates that he attached no — He said it could be anything. Well, as a matter of fact, it could be anything. For that reason he need not have described the material. [81]

Q. I don't know what these eight things are that you are talking about, but is it not true —

A. I will explain it to you if you wish.

Q. Is it not true, that as compared to making the parts in red of wood and making the parts in red of pure iron —

The Court: Is that with reference to the French device?

Mr. Cochran: With reference to the French device as shown in plaintiff's exhibit 8.

By Mr. Cochran:

Q. Is it not true that you would thereby take better advantage of the magnetic field generated by the coil?

A. In that case, if you made them of wood, made this casing of insulating material, then, of course, you don't have this problem here and, as a matter of fact

Q. We have forgot all about that.

A. Let me answer the question.

Q. I am going to interrupt you for a minute because it is not responsive.

Mr. Kendrick: Let him finish his answer, please.

By Mr. Cochran:

Q. We have ignored the generation of poles at the valve seat because we have said that for Fuscaldo we put as a condition of this question that we are providing a valve [82] outside the confines of the solenoid as shown by Fuscaldo. Now answer it without reference to the generation of any north and south poles at the valve seat.

A. Sir, your question is so vague and indefinite I will try to answer it.

Mr. Kendrick: If Your Honor please, this question is compounded. It should be broken down.

The Court: Well, I guess Mr. Cochran is skillful enough to put it in other words, if he cares to. It is clear to the Court.

By Mr. Cochran:

Q. Let's assume two things, first that we have provided the armature shown in purple in plaintiff's exhibit 8 with a stem connected to the valve outside the casing by non-insulating material —

A. Let me interrupt you, sir. This first assumption

—

The Court: Wait. He is asking you to assume something.

The Witness: I just want to be sure I know what I am assuming, sir.

The Court: Well if you listen you will find it. I hear it; I know it.

By Mr. Cochran:

Q. And that, secondly, you want to take the best [83] advantage of the field generated by this coil. Now would you get better advantage from it by using iron for the parts shown in red in the plaintiff's exhibit 8 or wood?

Mr. Kendrick: Excuse me. I am going to object to the question. It is not possible to answer because it doesn't say best for what, best for light weight, best for power; the question is indefinite.

The Court: Overruled.

The Witness: No, sir, the teaching there would still be that the body portion there should be of non-magnetic material.

By Mr. Cochran:

Q. Why do you say that?

A. Because if this part here adjacent the lower end of the core member were of magnetizable material we would still develop these poles at the lower end which would counteract the poles which you are trying to develop for useful purposes.

Q. All right, sir. Now you spoke of Gachon having gaps in the magnetic circuit. Now just summarize your testimony on that point, will you? Where are the gaps?

A. Well —

Q. As shown on plaintiff's exhibit 8.

A. To start with there is the gap between the upper end of the core member and the member 20 and —
[84]

Q. That is the so-called working gap?

A. Yes, sir. I would call that the working gap.

Q. All right.

A. And during movement of the core member from its seat there is this detrimental gap between the lower end of the purple core member and the valve seat. And the third is probably, as I have testified, between the core member and the inner core of member 5.

Q. What does the term reluctance mean? I am trying to relate this now to the question of the gaps, that is all I am trying to do.

A. Well, as I understand the term "reluctance" it has reference to impedance. It is analogous to impedance in electrical circuits.

Q. And the gaps would increase the reluctance?

A. Yes, sir.

Q. Now you are not saying that the plaintiff here discovered that gaps in a device of this kind should be reduced to a minimum; that is not your testimony; is it? Wasn't this well-known?

A. That was part of it, as I understand his concept, to have one working gap in the center, located in the center.

Q. Now let me refer you to the Fuscaldo patent at line 53, column 2, page 1. (Reading) "The magnetic

circuit is [85] indicated in Figure 1-B by arrows 6, the only gap therein" the only gap therein (Repeated) "being in the axial end-clearance 7 between the fixed armature 4 and the moving armature 5, which clearance corresponds exactly to the stroke of the valve."

There he says, does he not, that the only gap that he has is the working gap?

A. That is true.

Q. And beginning at line 7, page 2, column 1, the statement is made:

(Reading) "The side or radial clearance between the moving armature 5 and flange 2 guiding it, although minute, is a harmful gap which is required, however, for permitting the free shifting motion of sliding armature 5."

Now what is he talking about there?

A. Well, he is talking, as I understand it, about the fit between the armature 5 and the element 22.

Q. Element 2, I believe, is it not?

A. Yes, 2. Yes, he desires to make that close.

Q. So it was known, was it not, that you should make these gaps at a minimum, they should be minimized in order to minimize reluctance; isn't this so?

A. In that detail Fuscaldo indicates that to be true.

Q. Now the gap you are complaining about in Gachon, one of the gaps, is between the armature and the pole piece against [86] which it rests, is it not?

A. Yes. It is certainly not clear from Gachon because, first of all, he does not show a cross section of his core member, and since he does show this groove portion on the external part of his core member, it is for that reason I say, and also for the reason that core

members other than circular core members have been used in the art, there is a probability that he is not concerned in his disclosure with a close fit at that point.

The Court: It is time now for the usual morning recess. Court will now stand recessed until 11:30.

The Deputy Marshal: This Honorable Court stands recessed until 11:30.

(Whereupon, at 11:15 a.m. the Court recessed as noted and reconvened at 11:30 a.m.)

The Court: Mr. Kendrick, do you think we will finish this case today? If you don't finish by 4:00 o'clock we are going over until Monday. There is no Court held here on Saturday.

Mr. Kendrick: Yes, Your Honor. We will finish today.

The Court: All right.

Mr. Kendrick: We will finish this afternoon, Your Honor.

Mr. Cochran: I have just one or two more questions, [87] Your Honor.

The Court: All right.

By Mr. Cochran:

Q. Dr. Mauritz, if in the Gachon device as shown in plaintiff's exhibit 8 the parts colored in red are made of iron, as would be the armature which is colored purple, there would be a concentration of flux, would there not, in the working gap? A. Yes.

Q. Now would that concentration of flux be affected by the character of the material of the T-shaped member, whether it was magnetic or non-magnetic?

A. To some extent.

Q. How would it be affected? If it were non-magnetic would the flux be more than if it were magnetic?

A. Well, let me put it this way: Assuming a constant magnet moving force between the upper end of this member 20 and the lower end of the valve seat 6, there would be flux passing through member 20 through this working gap into the core; and also a flux passing through this T-shaped member regardless of what it was.

Q That doesn't answer my question. My question was whether you would have more or less flux in the working gap if the T-shaped member were non-magnetic. [88]

A. Well, I can say that from experiments —

The Court: Can't you answer that yes or no?

The Witness: Based on the experiments —

The Court: That is non-magnetic, understand, the T-shaped member —

The Witness: No, sir.

The Court: — On your question.

The Witness: On the question, assuming this to be non-magnetic, the experiments conducted would indicate or they have indicated that, with this non-magnetic, the force here would be greater; is greater.

By Mr. Cochran:

Q. Now did you have to make experiments to find that out? Wouldn't you have assumed that to be the case without experiments?

A. Well, experiments, sir, were conducted —

Q. Why don't you answer my question and then you can make whatever explanation you want?

A. All right, sir.

The Court: Well I am no electrician but the answer to that would seem to me to be obvious.

The Witness: Maybe I missed the question. Would you read it back?

The Court: The reporter will read the question.

Reporter (Reading): "Q. Now did you have to make [89] experiments to find that out? Wouldn't you have assumed that to be the case without experiments?"

The Witness: I would frankly think that there would be some improvement if they were non-magnetic.

Mr. Cochran: That is all I have, Your Honor.

The Court: Do you have any redirect?

Mr. Kendrick: I want to clear up one point only, Your Honor.

The Court: Very well.

Mr. Kendrick: The Government has not relied on the Hammond reference so far, the Bosch reference and the Heinrich reference.

The Court: I think Mr. Cochran has stated he is relying on two references. Is that correct?

Mr. Cochran: Yes, Your Honor, as I stated in my opening statement. If the trial continues as it has and some matter doesn't come up that makes these patents pertinent.

The Court: As it stands now, that is all you are relying on, Fuscaldo and Gachon?

Mr. Cochran: Yes, Your Honor.

Mr. Kendrick: Then I will put no testimony in on those other references because he has waived those.

The Court: That is right, because it isn't necessary. The record shows that the Government isn't depending on those [90] other references.

Redirect Examination

By Mr. Kendrick:

Q. Dr. Mauritz, Mr. Cochran has asked you to make a number of assumptions in answering certain of his questions; namely, assume that the pink member of Gachon were made of iron; and assume that the seat were extended. Are any of those assumptions suggested by the disclosure of the Gachon patent?

A. No, sir.

Q. Is there any suggestion in the Fuscaldo patent that the Gachon structure should be modified so that the external member is of magnetic material?

A. No, sir.

Q. And I believe you testified yesterday that there are a number of these armatures that are made in hexagonal and square shape, as you testified about plaintiff's exhibit 8-A, that shows that there are devices that have air gaps surrounding the armature; is that correct?

A. Yes. They are grooved and by their very nature of being square they would have spaces between the armature and the adjacent parts.

Q. Now if you wanted to make a light-weight airborne type of device from the teaching of Gachon, would you make the pink material of a magnetic material such as iron? [91]

A. No, because Gachon teaches me that the material is immaterial, it could be plastic, copper or —

Q. What type of sheeting is often used for coil that is non-magnetic, light-weight, if any?

A. Sometimes plastic and composition —

Q. Is there any non-magnetic metal that is used to sheet coil?

A. Sometimes not.

Q. Is there a non-magnetic material which is used to sheet coil that is light in weight?

The Court: A non-conductive substance, that is it, isn't it?

By Mr. Kendrick:

Q. Well, is aluminum used?

A. Oh, yes. Oftentimes aluminum is used and aluminum, of course, is non-magnetic. So following Gachon's teachings, which are that it is immaterial what the material is, you would pick a light-weight material and, particularly, you would pick a non-conductive material, probably aluminum, to avoid this development of secondary north and south poles, which when otherwise developed using magnetic material would defeat your purpose or act in the direction to defeat your purpose.

Q. Yesterday, Dr. Mauritz, you testified that the Eckel device as shown on the drawings in plaintiff's exhibits 2 and 4 [92] included the structure called for in claim 7. Did they also include the structure called for in claims 9 and 11?

A. Yes, definitely.

Mr. Kendrick: If Your Honor please, we would like to offer in evidence plaintiff's exhibits 2 and 4, which Mr. Cochran has already stipulated to.

Mr. Cochran: I am not sure that I have stipulated to the admission of these until I know exactly the purpose for which they are offered. What is the purpose of 2 and 4, again?

Mr. Kendrick: Well, I am going to show through another witness that this valve —

The Court; Why don't you wait until you have the other witness on the stand? I asked you to put them in in their proper order.

Mr. Kendrick: If your Honor please, the purpose first is to show that the drawings conform to the claims. You would want to know if the things made in these drawings are the things we claim in our invention.

The Court: I don't believe there is any controversy about that, is there?

Mr. Cochran: Well, I don't know what these drawings are supposed to show. These drawings are supposed to show something that was sold, something that has gone into commerce; [93] and I think that is the only purpose of these two drawings.

Mr. Kendrick: That is right.

The Court: If that is the only purpose you have no objection then.

Mr. Cochran: I don't know why this is pertinent to the case, Your Honor, whether or not they have been sold. Certainly if it is commercial success —

Mr. Kendrick: If Your Honor please, we want to establish that it met a long-felt want, the thing made in accordance with the claims met a long-felt want.

The Court: Well, I don't think there is any objection to that.

Mr. Cochran: Well, Your Honor —

The Court: He has to show that by witnesses as they appear. Is that correct?

Mr. Kendrick: That is correct. So first we have to establish that the drawings from which the things were made followed the patent claims. Otherwise, the Government would argue on rebuttal that while we may have tried to get a patent on one thing the thing that met the

want was a different device. We have to tie it with the claims.

Mr. Cochran: I don't want to say that I will object to these, Your Honor, but I don't, at the same time, want to fail to object because I don't want to be precluded from [94] contending that they are not pertinent, because I think they may well not be pertinent.

The Court: I am wondering how in the world you can tell whether or not they are pertinent until some witness is put on the stand to testify as to what they are intended for. •

Mr. Kendrick: Your Honor, first —

The Court: Can't you do that? You have three more witnesses, haven't you?

Mr. Kendrick: Two more, Your Honor.

Dr. Mauritz has testified that 2 and 4 conform to the drawings. I am introducing them to show that these drawings conform to the claims. Now I have another witness to state something further.

The Court: Is there any contention that they don't?

Mr. Cochran: There is no contention they don't conform to the claims. It is just that I think they are properly in now for identification, and perhaps some witness later can demonstrate how they are pertinent.

The Court: Those are only two of the claims here he is talking about.

Mr. Kendrick: Three. Exhibits 2 and 4 are made in accordance with three of the claims, 7, 9 and 11.

The Court: Well, if it is an objection I will overrule it. They can go in for what they are worth, but I [95] can't see how in the world how it could be otherwise. They conform to the claims.

By the way, do you make any distinction between the patentability of these claims and the others, or do they all stand or fall together?

Mr. Kendrick: If Your Honor please, claims 9 and 11 call for one additional feature.

The Court: I am asking you whether or not you say they all stand or fall together or whether they should be treated separately. That is all I am asking you.

Mr. Kendrick: I suggest 9 and 11 are the same and 7 has one less limitation.

The Court: All right. That is not answering my question though. Call your next witness.

The Deputy Clerk: Plaintiff's Exhibits 2 and 4 are received in evidence.

(Plaintiff's Exhibits No's. 2 and 4 were received in evidence.)

The Court: Oh, do you want some recross?

Mr. Cochran: Yes, Your Honor.

The Court: Oh, very well. The witness will resume the stand. I had forgotten about that. I am glad you called my attention to it.

You may proceed. [96]

Recross Examination

By Mr. Cochran:

Q. Dr. Mauritz, I understood you to say there was no suggestion in Fuscaldo that the Gachon casing be made of magnetic material. Did you say that?

A. Well, it would be contrary.

Q. I asked you what you said. I am not asking you to characterize it. Just state whether or not you said that; was that your testimony?

A. Just about. Yes, sir.

Q. All right. What material does Fuscaldo encase his coil in?

A. He cases it in magnetizable material.

Mr. Cochran: All right. That is all.

The Court: Are you through with the witness?

Mr. Kendrick: Yes, Your Honor.

The Court: Call your next witness.

Thereupon —

MR. JAMES L. McCOY

was called as a witness by and on behalf of the plaintiff and, having been first duly sworn, was examined and testified as follows:

Direct Examination

By Mr. Kendrick: [97]

Q. Would you state your name for the record, please?

A. James L. McCoy.

Q. And what is your profession?

A. I am an engineer.

Q. And have you had any formal training in engineering?

A. Yes, I am a graduate of the University of California at Los Angeles.

Q. And are you a licensed engineer?

A. I am a registered electrical and a registered mechanical engineer in the State of California.

Q. When did you graduate from the Engineering School at the University of California?

A. I didn't graduate from the Engineering School. At that time the University of California at Los Angeles had no Engineering School. I graduated in Physics and Mathematics.

Q. And what was that date, please?

A. 1936.

Q. And have you had any experience in the aircraft industry?

A. Yes. In 1937 I became a member of the Air Force and remained in the Air Force until 1946.

Q. In the course of your Air Force career, did you have anything to do with aircraft instrumentation?

A. Yes. I was Chief of the Instrumentation Section of [98] the Flight Test Division of the Air Materiel Command in Wright Field.

Q. And in the course of your work at Wright Field, did you have an occasion to come in contact with so-called solenoid operated valves?

A. Yes, sir.

Q. And could you tell us, please, some of the uses for solenoid valves in the aircraft industry?

A. Basically solenoid valves are used in the aircraft industry any place it is necessary to employ a valve to have remote control, where it is not possible for a man to manually control the valve. And this must be done electrically from a remote location, which is a frequent application in our factory.

Q. I will invite your attention to plaintiff's exhibit 11-B and ask you if you can identify the structure marked 11-B as to what kind of structure that is?

The Court: Is that 11-B for identification?

Mr. Kendrick: Yes, Your Honor.

The Witness: This apparently is an external configuration. It is an electrically operated solenoid valve and is what is known as the T configuration. In other words, the solenoid sets on here and the flow passages are down here in the form of a T. [99]

By Mr. Kendrick:

Q. And to your personal knowledge, were such valves used in the aircraft industry while you were at Wright Field?

A. Yes.

Q. And in what years was that?

A. I was at Wright Field from 1941 to 1946.

Q. And is there any particular property that the aircraft industry desired in airborne devices, specifically as to valves?

A. Yes. This applies to valves and other accessories as well. The major problem always is weight, to try to reduce the weight of the components, because any weight that may be cut off without reducing the performance of the part then becomes available as useful payload to the aircraft.

Q. And is that true in the Government's programs with respect to the missile industry and astronautics as well as in aircraft?

A. It would be more true there because of the larger fuel to overall weight ratio that is involved.

Mr. Kendrick: If Your Honor please, we will offer in evidence the valve which has been marked for identification.

The Court: Have you seen it, Mr. Cochran?

Mr. Cochran: Yes, Your Honor. I would object to the introduction of this. I don't know what it has to do with this case. In fact, I don't know what this whole line of [100] testimony is intended to prove. Some mention has been made of weight reduction and —

The Court: It is supposed to show a problem, according to the contention of counsel for the plaintiff here, which was worked on for a long period of time and

finally the problem was solved by this inventor. Isn't that correct?

Mr. Kendrick: That is right, Your Honor.

The Court: I will overrule your objection.

The Deputy Clerk: Plaintiff's Exhibit Number 11-B is marked in evidence.

(Plaintiff's Exhibit No. 11-B was marked in evidence.)

By Mr. Kendrick:

Q. I invite your attention to exhibit 11-A. Would you state what that circular shows?

A. The brochure —

The Court: Is that circular marked for identification?

Mr. Kendrick: It is marked for identification as plaintiff's exhibit 11-A, Your Honor.

The Court: All right.

The Witness: The brochure sheet here illustrates the T-Type Solenoid Valve —

The Court: That is the one you just testified to?

The Witness: No, this is a different valve, Your [101] Honor.

The Court: All right.

The Witness: It appears to be a valve manufactured by Minneapolis-Honeywell, a great many of which were used in industry, and also they were used on aircraft.

By Mr. Kendrick:

Q. In your experience in the Air Force were you familiar with such valves?

A. Yes, I was.

Q. After leaving the Service, could you tell us what occupation, if any, that you had?

A. I became Vice-President In-Charge of Engineering of the Revere Corporation of America, Wallingford, Connecticut, who were manufacturers of aircraft components. In the course of this we manufactured fuel flow heaters, which included valves.

Q. Did there come a time in your work at Revere that you came in contact with Mr. Eckel?

A. Yes, sir.

Q. Would you tell the Court about your contact with Mr. Eckel and particularly as to whether you ever learned of an Eckel Valve while you were at Revere?

A. Yes. In about 1952, I believe it was, I was shown an extremely small, light-weight valve which had been developed [102] for aircraft. I was very much impressed with this and I had never seen before a valve of this performance incorporated in a small and light envelope as this particular valve. As the Vice-President of Revere I was interested in the potentialities of that in the aircraft industry and arranged to meet Mr. Eckel. Subsequently we negotiated a contract with Mr. Eckel, an agreement with Mr. Eckel, that would permit us in the Revere Corporation of America to manufacture this valve.

The Court: Under a license?

The Witness: Yes, sir.

Manufacture this valve for general use, but specifically since our products were aircraft and missile products this was our field.

By Mr. Kendrick:

Q. I will invite your attention to plaintiff's exhibits 2 and 4 and ask you, please, whether or not the valve that you examined at Eckel had the arrangement of

parts shown on plaintiff's exhibit 2 and plaintiff's exhibit 4?

A. Yes, sir, this is the coaxial valve in question.

Q. Did the Eckel Valve Company supply you with drawings on such devices?

A. Yes, they supplied us with drawings of this device and probably twenty different variations for different applications. [103]

Q. Now prior to the time that you entered into an agreement with Mr. Eckel, did you make any investigation as to whether or not the Eckel Valve was of any interest to the aircraft industry?

A. Yes. When we determined that Mr. Eckel would be receptive to a license agreement we obtained from him samples of the valve and I personally then conducted a market survey by showing these valves to various people in the industry, engineering people in corporations such as North American, Douglas, Chance Vaught, McDonnell, major aircraft corporations to obtain their reaction to it to see whether they were as favorably impressed with it as I was; and the reaction was enthusiastic.

Q. What did the valve do that they were looking for, if anything?

A. Well, it did something they were looking for for a long time. It filled a long-standing need.

Q. And what was that long-standing need?

A. Light weight, small space and high performance.

Q. Were the T-shaped solenoid valves the standard of the industry at the time you made this investigation?

A. Yes, they were.

Q. Would you tell the Court, please, the weight relationship, approximately, that was saved by using the design of the [104] kind shown on plaintiff's exhibits 2 and 4?

A. I would say that basically the weight savings were a factor of at least four or five times.

Q. By four or five times —

A. In some cases more than that.

Q. In other words, the T-shaped valves would be about four times as heavy as the Eckel valves to do a given job?

A. The lightest T-shape valves which I was familiar with would be. Now the other T-shaped valves were much heavier.

Q. You are comparing it with the lightest T-shaped valves?

A. The lightest T-shaped valves which I was familiar with.

Q. So job for job a 2-ounce Eckel Valve would do the work of an 8-ounce T-shaped valve?

A. Yes.

Q. Now you mentioned companies such as Lockheed, did you actually go to Lockheed?

A. Yes, sir.

Q. Did you actually go to Douglas?

A. Yes, sir.

Q. Did you actually go to North American?

A. Yes, sir. [105]

Q. Did you actually go to Northrop?

A. Yes, sir.

Q. Did you actually go to Consolidated?

A. Yes, sir.

Q. Did you actually go to Boeing?

A. Yes, sir.

Q. Did you go to Martin? A. Yes, sir.

Q. Did you go to Chance Vaught?

A. Yes, sir.

Q. And was there any uniformity in the reaction of these companies? A. Yes, sir.

Q. Would you state —

The Court: Was there a general reaction?

The Witness: There was a uniform enthusiasm, Your Honor.

By Mr. Kendrick:

Q. There was a uniform enthusiasm for the Eckel design as shown on plaintiff's exhibits 2 and 4?

A. Yes, sir. They felt that this had met the need they had for a long time for a light-weight, high performance valve.

Mr. Kendrick: If Your Honor please, we would like to [106] introduce into evidence the plaintiff's exhibit 11-A, the brochure showing one of the prior art type valves which the witness testified weighed about 8 ounces.

The Court: Have you seen that, Mr. Cochran?

Mr. Cochran: I think this was part and parcel to what I objected to a few minutes ago, Your Honor. I just fail to see the relevancy of it.

The Court: Your objection is overruled. It may be marked and received in evidence.

The Deputy Clerk: Plaintiff's Exhibit 11-A is marked in evidence.

(Plaintiff's Exhibit 11-A was received in evidence.)

By Mr. Kendrick:

Q. Mr. McCoy, I invite your attention to an Eckel Valve that we have marked plaintiff's exhibit 3 for identification, and to an Eckel Valve that we have marked plaintiff's exhibit 3-A for identification, and to an Eckel Valve that we have marked plaintiff's exhibit 3-C for identification. Inviting your attention to plaintiff's exhibits 3 and 3-C, can you identify these as Eckel Valves of the kind that you showed to the aircraft industry at the time you were making your investigation, to which you just referred? A. Yes, sir. [107]

Mr. Kendrick: We would like to offer these in evidence, Your Honor.

The Court: Without objection they may be received in evidence.

The Deputy Clerk: Plaintiff's Exhibits 3, 3-A and 3-C are marked in evidence.

(Plaintiff's Exhibits No. 3, 3-A and 3-C were received in evidence.)

By Mr. Kendrick:

Q. I invite your attention to what has been marked plaintiff's exhibit 14 for identification and —

The Court: What is it?

Mr. Kendrick: This is a photograph —

The Court: I want the witness to testify as to what it is.

By Mr. Kendrick:

Q. Could you identify this device?

The Court: That picture.

The Witness: Yes, sir. This is a picture of one of the small Eckel Company coaxial valves being held in a hand.

Mr. Kendrick: We offer it in evidence, Your Honor.

The Court: It may be received.

The Deputy Clerk: Plaintiff's Exhibit Number 14 is [108] marked in evidence.

(Plaintiff's Exhibit No. 14 was received in evidence.)

Mr. Kendrick: I have no further questions, Your Honor.

The Court: Cross-examine.

Mr. Cochran: No questions, Your Honor.

The Court: You may be excused. Call your next witness.

Mr. Kendrick: Mr. Eckel, will you take the stand, please.

Thereupon —

MR. VINCENT W. ECKEL,

the plaintiff herein, was called as a witness in his own behalf and, having been first duly sworn, was examined and testified as follows:

Direct Examination

By Mr. Kendrick:

Q. Would you state your name for the record, please?

A. Vincent W. Eckel.

Q. And where do you reside, Mr. Eckel?

A. 1425 East First Street, San Fernando, California.

Q. And would you state your business or profession, please? [109]

A. Design Engineer.

Q. And are you licensed to practice engineering in any state?

A. I am licensed in the State of California.

Q. And have you have any formal technical training?

A. No.

Q. Have you studied physics and chemistry?

A. I studied physics and chemistry but not engineering.

Q. And would you relate to the Court, please, the experience, if any, that you have had in the engineering business?

A. I have designed industrial products, including industrial solenoid valves, starting in the late 1930's, '35 to '36.

Q. And what type of solenoid valves were you designing at that time?

A. Those were commercial, that is non-aircraft types.

Q. And inviting your attention to plaintiff's exhibit 11-B, which has been marked in evidence, did you ever do any designing work on valves of that type?

A. Yes, I have. These are T-configuration valves.

Q. And when did you do design work on valves of that kind?

A. Industrially in 1937 and '38, and also in aircraft [110] in 1941 and 1942.

Q. And did you do any design work on valves in '43 or '44? Was that the end of your design work experience on valves?

A. No, I continued but not in this type.

Q. What type did you work on after that?

A. I was Chief Engineer at State Valve Company and the administrator of other designers.

Q. In what company?

A. State Valve Company.

Q. And where are they located?

A. They have been absorbed by the William R. Whitaker Company.

Q. Now based on your experience — First, could you tell us the purpose for which the valves of the kind you have before you marked plaintiff's exhibit 11-B were used in the aircraft industry, if they were?

A. The valves of this type, T-configurations, were used largely in fuel systems, in hydraulic systems and in pneumatic systems.

The Court: Of aircraft?

The Witness: Yes, sir.

By Mr. Keindrick:

Q. Now did the use of such valves in aircraft continue [111] after World War II? Did the use of such valves extend beyond World War II?

A. Yes, sir.

Q. Do you know of a company by the name of AiResearch in California?

A. I do.

Q. And, under your direction, was a survey made as to the type of valves that they were using on or about in 1949? I will invite your attention to plaintiff's exhibit 11-C for identification.

A. This is a survey made by the Saval Company of the needs of the AiResearch Corporation pertaining to small valves which ultimately would be used by the major manufacturers. Douglas, Lockheed, etc., in the aircraft industry. Yes, I recognize this piece of paper.

Q. When was that survey made?

A. This was made February 1st, 1949.

Q. And does that survey refresh your recollection as to the approximate weights of valves that were used by AiResearch at that time?

A. It does.

Q. And what weight valves are reflected thereon that they were then using?

A. Minneapolis-Honeywell — 9 and 1/2 ounces, General [112] Controls — 8 ounces, Adel — 6 ounces, Pacific Airmotive — 4 ounces.

Q. Now, Mr. Eckel, you have mentioned the AiResearch Company; is that a large organization in supplying components to the aircraft industry?

A. Yes, it is.

Q. Do they supply the pressurization equipment that is used by major aircraft companies?

A. Almost all types of pneumatic equipment, including pressurization; yes, sir.

Q. Are they the largest company in this industry?

A. I believe they are.

Q. And by pressurization, would you tell the Court what that is in aircraft?

A. It is equipment for maintaining cabin pressure in all sorts of aircraft.

Q. Maintaining cabin pressure where?

A. Maintaining cabin pressure at altitudes.

Q. In other words, as you go up the pressure rises?

A. Yes, sir.

Q. And it is to maintain the pressure of a lower altitude?

A. Yes.

Q. And based on your experience in design aircraft [113] valves, can you tell the Court the importance, if any, that AiResearch placed on weight and which the industry did in general, if you know?

A. The general relationship between weight and cost varies from one estimator to another as between \$200.00 per pound and \$400.00 per pound. And the implementation of that means that if we could design a piece of equipment that was one-pound lighter than a previous piece of equipment, and if it cost \$200.00 each for those units, that the airplane companies would buy them.

Q. Have you been connected with any of the missile projects? Have you made valves for any missile projects?

A. Yes.

The Court: Where would they be, in the missile proper or in the launching apparatus?

The Witness: In the missile proper.

The Court: I see.

By Mr. Kendrick:

Q. And could you tell us, please, the importance, if any, the missile industry places on the weight of valves?

A. In the general cost of the vehicle the cost of one added pound of weight I am sure has gone up ten times and possibly as high as one-hundred times because the payload is [114] so very tiny.

Q. What do you mean by the payload?

A. Well, when you have a large two or three stage rocket booster which weighs many, many tons, it is all for the purpose of getting this tiny little space capsule perhaps in orbit.

The Court: And that is the payload, is it?

The Witness: That is the payload.

By Mr. Kendrick:

Q. And it is extremely important that the payload be as light as possible?

A. We used to fight ounces. Now we fight small fractions of ounces.

Q. And is it a fact in the free world, as was reported in the press, that we were having problems matching the Russian boosting power and we were meeting this by using a lighter payload?

A. I believe that is correct.

Q. Now you mentioned that you had a market survey made in 1949 with respect to valves and you found a problem facing industry —

Mr. Kendrick: Excuse me, Mr. Cochran.

Mr. Cochran: If Your Honor please, I think a large [115] part of this testimony is repeating material which is in an affidavit filed by Mr. Eckel in the case. Perhaps we could save time if he would just adopt the statements made in that affidavit.

The Court: Ordinarily the affidavit is supposed to be objected to by the opposing side for live witnesses in Court. He can do as he pleases on that.

Mr. Cochran: I am just saying he has an affidavit of record in the Patent Office and he could adopt the statements in his affidavit as his testimony here. It would just save time.

The Court: I know, but he is trying his own case.

Mr. Kendrick: Well, as Your Honor suggested, we would much prefer live witnesses. This will be short.

By Mr. Kendrick:

Q. Now in 1949 you made this survey at AiResearch and found out the valves they were using?

A. Yes.

Q. Inviting your attention to plaintiff's exhibit 12, did there come a time when you believe that you had a valve that would supply a need of AiResearch for light-weight valves?

A. Subsequent to '49?

Q. Yes.

A. Yes. [116]

Q. And inviting your attention to plaintiff's exhibit 12, does that refresh your recollection as to a date?

A. This is dated June 7th, 1951, and it is a request for quotations from AiResearch Manufacturing Company for 600 valves.

Q. For 600 valves?

A. For 600 valves; yes.

Q. And at that time had you showed them a valve?

A. We had a prototype only closely approximating the exhibit identified by Mr. McCoy which he used in his survey.

Q. Plaintiff's Exhibits 2 and 4?

A. That is correct.

Q. And what was the price which you quoted for 600 valves, if you recall, approximately?

A. \$13.76.

Q. Now what would the valves you quoted weigh?

A. They weighed 1 and $\frac{7}{8}$ ounces each.

Q. And from the exhibit 11-C in front of you I note the valves ranged from 5 to 9 ounces, is that correct?

A. The valve whose use was replaced. The valve which my little valve displaced weighed 10 ounces, sir.

Q. So that there was a saving there of 5 to 1?

A. Over 5 to 1, that is right.

Q. Over 5 to 1. And I believe you testified that [117] AiResearch and similar companies could afford to spend \$200.00 to save 1 pound?

A. They would be very glad to.

Q. Now after the initial order from AiResearch did they indicate to you whether or not the valves which you delivered to them — in accordance with plaintiff's exhibits 2 and 4 — met any need that they had?

A. Yes, they did. The small size of the Eckel Valve permitted them to completely redesign their whole line of cabin pressure regulators, whereby they surrounded the miniature valves with the cabin pressure regulator housing. Previously they had mounted larger valves outward of the housing on brackets. These valves were now so small that they were incorporated in the housing and this reduced their product by size and weight.

Mr. Cochran: If Your Honor please, I don't believe there is any basis for these statements that has been laid as to how this witness knows this is the case.

The Court: Well, you had better qualify him. I assumed from his experience that he has testified to that he is qualified.

By Mr. Kendrick:

Q. Did you actually go over to AiResearch and see how they were using your product? [118]

A. I did.

Q. And you stated that after the initial order of 600 valves that they indicated to you that these valves had met a need. Now did they go so far as to reorder these valves from you?

A. They have been in continuous production since that time.

Q. And how many thousands of valves have you delivered to them, approximately?

A. We have shipped 55,000 of those valves to AiResearch in the last thirteen years.

Q. And has the management of AiResearch indicated to you that these are reliable valves?

A. Yes.

Q. By reordering?

A. That is correct.

Q. Inviting your attention to plaintiff's exhibit 15, does plaintiff's exhibit 15 represent the application of your valves to AiResearch of which you have personal knowledge?

Mr. Cochran: Is this exhibit 15 for identification?

Mr. Kendrick: Exhibit 15 for identification. Yes, to which you stipulated you had no objection.

The Witness: This advertisement refers to their line [119] of auxilliary power units, each of which — Correction — two of which we know to carry a miniature Eckel Valve.

Would you care for a description of the purpose and function? This is a new type of product. This is not the original cabin pressure regulator, which is an utterly different field, for the same company, of course.

By Mr. Kendrick:

Q. So AiResearch started with one use of your valve and then extended to other uses?

A. Yes, sir.

Q. Inviting your attention to plaintiff's exhibit 5-A for identification — which we have shown to the Government counsel — could you tell us whether or not that valve embodies the parts shown in plaintiff's exhibits 2 and 4?

A. This is a valve designated AF 70. It is an attempt to further shrink the original valve, which was an AF 42 of this size (demonstrating) to meet needs for still smaller devices.

Q. And what does the valve AF 70, plaintiff's exhibit 5-A, weigh, approximately?

A. This weighs $\frac{7}{8}$ of 1 ounce. It does not have the same capacity, however.

Q. Does plaintiff's exhibit 5-A have the arrangement of parts shown in the drawing on plaintiff's exhibit 2? [120]

A. Yes, sir.

Q. And inviting your attention to plaintiff's exhibit 3-A, does it have the arrangement of parts shown in the drawings on plaintiff's exhibits 2 and 4?

A. Yes, sir.

Q. And does plaintiff's exhibit 3-C have the arrangement of parts as shown in plaintiff's exhibits 2 and 4?

A. Yes, sir.

Q. And does plaintiff's exhibit 18 for identification have the arrangement of parts as shown in plaintiff's exhibits 2 and 4?

A. Yes, sir.

Q. And does plaintiff's exhibit 5 have the arrangement of parts as shown in plaintiff's exhibits 2 and 4?

A. Yes, sir.

Q. Now would you tell the Court, please, what need, if any, in the industry has been met by the Eckel Valve AF 70, plaintiff's exhibit 5-A? To what use has this valve been put, if any?

A. I can only say that this valve has been used most recently on the successful flight two days ago, dated 4/15, I believe, in which the booster was a TITAN II and the project was designated "FIRE" F-i-r-e. I am unable to learn the purpose for which this valve was used because it is classified. [121]

Q. Now inviting your attention, please, to plaintiff's exhibit 3-A, could you tell the Court the purposes for which that valve has been used?

A. Exhibit 3-A is our model of the AF 77. It has been used on the Gemini orbiting capsule in the oxygen system.

It has been used in the Mercury space orbiting capsule for the purpose of recording the pressure — blood pressure — of the astronaut.

It was also used in the Mercury space vehicle in connection with the feeding of the chimpanzee who was strapped upon a couch.

It has also been used in the Surveyor project in which it opens and closes a gas sampler.

It has been used to operate control systems in the attitude control of a classified project.

It has been used on the heat exchanger of the Skybolt project.

It has been used as an air bleed valve on the project Roadrunner.

It has been used as an air bleed valve on the project Redhead.

I have no further knowledge of its use.

Q. Was a factor in selecting all those uses which you have described that it was smaller than other valves that [122] could be employed to do the same work

A. Yes, sir.

Q. I believe you have testified this weighed what?

A. 1 and $\frac{7}{8}$ ounces.

Q. Now inviting your attention to plaintiff's exhibit 5, would you tell the Court, please, the purpose for which this valve has been used? And in this regard, I invite your attention to plaintiff's exhibit 9 for identification.

A. The valve is our model AF 56. It was used as shown in the photograph, exhibit 9, in the attitude control system on the Mercury space capsule. All of the capsules that have ever taken Americans around the world contained 8 valves of this type. Their purpose was to permit ejections of hydrogen peroxide whose reaction gave a turning movement of the space capsule. They constituted the astronaut's only means of orienting himself, controlling his attitude in space. He could roll, he could pitch, he could yaw, and whenever he flew by wire — or whenever he flew by his automatic devices — these valves controlled the flow of hydrogen peroxide fuel.

The Court: It is time now for the usual noon recess. Court will stand in recess until 1:45 this afternoon.

The Deputy Marshal: This Honorable Court stands recessed until 1:45 this afternoon.

(Whereupon, at 12:30 p.m. the Court recessed.)

[123]

PROCEEDINGS

Afternoon Session Friday, April 17, 1964 1:45 p.m.

The Court: Mr. Eckel may resume the stand. He has already been sworn.

You may proceed, Mr. Kendrick.

Direct Examination (Resumed)

By Mr. Kendrick:

Q. Mr. Eckel, inviting your attention to plaintiff's exhibit 15 for identification, you testified that two of the devices shown on that advertisement of AiResearch Corporation had Eckel Valves. Are those the two that are indicated by the numbers which have been inserted in ink with an arrow pointing from the two numbers to two of the devices on that exhibit?

A. Yes, sir.

Mr. Kendrick: Your Honor, I offer plaintiff's exhibit 15 in evidence.

Mr. Cochran: No objection.

The Court: Mark it in evidence.

Pass it to the Clerk, please, Mr. Kendrick.

The Deputy Clerk: Plaintiff's Exhibit 15 is marked in evidence.

(Plaintiff's Exhibit No. 15 was received in evidence.) [124]

By Mr. Kendrick:

Q. Inviting your attention to plaintiff's exhibit 3—

The Court: For identification?

Mr. Kendrick: For identification, Your Honor.

By Mr. Kendrick:

Q. Could you tell us, please, Mr. Eckel, the use, if any, that has been made of that valve?

The Court: I thought he has already testified to many uses that were made of it?

Mr. Kendrick: Not that particular valve, number AF 42, Your Honor.

The Court: I see.

The Witness: This valve is identical to the others but it has different applications. This was used in cabin pressure regulators. Its usage for that purpose was 55,000 units.

By Mr. Kendrick:

Q. By whom?

A. By AiResearch.

Mr. Kendrick: I offer plaintiff's exhibit 3 for identification in evidence, Your Honor.

Mr. Cochran: No objection.

The Court: Mark it.

Pass it over to the Clerk. You must always do that.

[125]

The Deputy Clerk: Plaintiff's Exhibit Number 3 is in evidence.

(Plaintiff's Exhibit No. 3 was received in evidence.)

By Mr. Kendrick:

Q. Inviting your attention to Plaintiff's Exhibit 3-C, would you tell the Court —

The Court: Is that for identification too?

Mr. Kendrick: Yes, Your Honor.

By Mr. Kendrick:

Q. Will you tell the Court what plaintiff's exhibit 3-C is?

A. This exhibit is a cutaway, a valve from which a section has been cut so as to expose the internal construction and the shape of the parts.

The Court: Were all of those valves which you have testified to made in accordance with your present application?

The Witness: Yes, Your Honor.

By Mr. Kendrick:

Q. Inviting your attention to plaintiff's exhibit 3-C, does it have the arrangement of parts as shown in plaintiff's exhibit 2, the drawing?

A. Yes, sir.

Q. Now inviting your attention to plaintiff's exhibit 18, [126] can you identify that, please?

A. Yes, this is an AF 35 model which was used by Douglas Aircraft submerged in the wing tank so that the coil itself was submerged in the fuel and only the electrical connector projected.

The Court: Is that one of the heavier valves that yours is supposed to supersede?

The Witness: No, sir. This is mine but this (indicating) is the only portion of the valve, Your Honor. The rest of it is to permit it to be attached.

The Court: I see.

The Witness: These were attached to the Douglas Attack Bombers since about January, '52 or '53.

The Court: Is that peculiar with respect to its lightness in weight? Did that supersede valves that had been used in that respect that were heavier?

The Witness: No, Your Honor. This is the first application, to my knowledge, for any solenoid valve of any description that had ever been used on a military aircraft where it was submerged within the fuel.

The Court: Are they still in use?

The Witness: They are still in use, sir. This is only to show the novelty, not the light-weight.

By Mr. Kendrick: [127]

Q. Does that valve have the arrangement of parts as shown in plaintiff's exhibit 2, the drawing?

A. The internal nature of the parts; yes.

Mr. Kendrick: If Your Honor please, I offer plaintiff's exhibit 18 in evidence.

The Court: Very well, it may be received.

Mr. Kendrick: If Your Honor please, just before lunch we identified plaintiff's exhibit 3-A, 5-A and —

The Court: I know, it has already been done.

Mr. Kendrick: And I would offer those in evidence.

The Court: All right.

Mr. Cochran: No objection.

The Court: There is no objection. Have them marked. Give them to the Clerk.

The Deputy Clerk: Plaintiff's Exhibits 3-A, 3-C, 5, 5-A and 18 are marked in evidence.

(Plaintiff's Exhibits No's. 3-A, 3-C, 5, 5-A and 18 were received in evidence.)

By Mr. Kendrick:

Q. Inviting your attention to plaintiff's exhibit 16 for identification, would you tell the Court, please, what that list shows, if you know?

A. This is a list prepared by my company to show the [128] degree of experience we have had in applying our valves to Aerospace projects.

The Court: All leading up to your present application?

The Witness: All of these devices used the subject matter in the application; yes, sir.

Mr. Kendrick: We offer exhibit 16 in evidence, Your Honor.

Mr. Cochran: No objection.

The Court: It may be received. Have it marked.

The Deputy Clerk: Plaintiff's Exhibit 16 is marked in evidence.

(Plaintiff's Exhibit No. 16 was received in evidence.)

Mr. Kendrick: Plaintiff's Exhibits 3 and 18, which the witness testified about, are offered in evidence.

Mr. Cochran: No objection.

The Court: They may be marked.

The Deputy Clerk: Plaintiff's Exhibits 3 and 18 are marked in evidence.

(Plaintiff's Exhibits No's. 3 and 18 were received in evidence.)

By Mr. Kendrick:

Q. Inviting your attention to plaintiff's exhibit 9—

The Court: For identification? [129]

Mr. Kendrick: For identification, Your Honor.

By Mr. Kendrick:

Q. Can you tell the Court what is shown on that photograph?

A. This photograph was taken by the Bell Aircraft Corporation and it shows how they attached our valves, the Eckel Valves, to the Mercury space capsule. Two valves are shown and they are both produced by my company.

Q. And do both of those valves embody the arrangement of parts as shown on plaintiff's exhibit 2, the drawing?

A. Yes, sir.

Q. And you testified this morning there were 8 valves of one kind. What were those?

A. There are 2 valves shown here, sir. There are 8 pairs.

Q. How many valves were on the Mercury space capsule?

A. There was a total of 16 of the type shown in this photograph used on the Mercury space capsule with 2 additional smaller valves used for non-critical purposes. These were critical.

Q. What were those used for?

A. These controlled the attitude of the space capsule so that the astronaut could require roll, pitch or yaw control as he found it necessary. [130]

The Court: What is the difference between a pitch and a yaw, or a roll and a yaw? It is a roll, isn't it?

The Witness: It is a roll; yes, sir.

The Court: That is what I thought.

The Witness: A pitch is like this (demonstrating) and a yaw is like that.

So these valves were the means by which he was able to control his attitude during orbit. Of course, it really doesn't matter what this attitude is for most purposes because he is in a weightless area. But it was critical to the success of this flight that when he is firing his retro-rockets to slow down and thus to approach the earth he pierces the atmosphere. When he does that he must aim his capsule so that the nose cone strikes first and it burns away. So the function, let me say, of these valves was of the highest importance.

Mr. Kendrick: I will offer exhibit 9 in evidence, Your Honor.

Mr. Cochran: No objection.

The Court: It may be received without objection.

The Deputy Clerk: Plaintiff's Exhibit 9 is marked in evidence.

(Plaintiff's Exhibit No. 9 was received in evidence.) [131]

By Mr. Kendrick:

Q. Inviting your attention to what purports to be a letter from Bell Aerosystems Company to Mr. Eckel, plaintiff's exhibit 10 for identification, can you identify that document, please, and can you tell the Court the subject matter to which the letter pertains?

A. This is a letter to me from Bell Aerosystems Company, who purchased the valves in the previous exhibit which were intended for use on the Mercury space capsule. Following the flight of Colonel Glenn the Bell Aerosystems Company sent this letter to me. The general tenor of the letter is that we are congratulated on the success and looking forward to continued progress in the space effort.

Q. Well, what products of yours were they congratulating you for the use of?

A. The 16 valves which this company had bought for building into the attitude control system which went on the Mercury space capsule.

Mr. Kendrick: I offer plaintiff's exhibit 10 in evidence, Your Honor.

Mr. Cochran: If Your Honor please, this is a letter, and I would have no objection to it going in just as proof that Mr. Eckel received it, but I don't believe it is proof of the contents. [132]

The Court: It shows their satisfaction with the product that he makes.

Mr. Cochran: I don't think we should let it in for that purpose without an opportunity to cross-examine the man who sent it. It is hearsay otherwise.

The Court: I will overrule your objection. It may be marked in evidence.

The Deputy Clerk: Plaintiff's Exhibit Number 10 is marked in evidence.

(Plaintiff's Exhibit No. 10 was received in evidence.)

By Mr. Kendrick:

Q. Inviting your attention to plaintiff's exhibit 13 for identification, can you identify that airbrush photograph for the Court, please?

A. Yes. This is a very complicated piece of equipment which contains one Eckel Valve as designated BF 63.

The Court: Is that a payload?

The Witness: Yes, sir.

The Court: I thought so.

The Witness: This is on the Surveyor project and the general function is lunar landing. The mechanism shown in the photograph is a "variable orifice rocket engine in connection with the lunar landing, not [133] from departure from the earth. So this is all payload.

Mr. Kendrick: I offer plaintiff's exhibit 13 for identification in evidence, Your Honor.

Mr. Cochran: No objection.

The Court: It may be marked and received.

The Deputy Clerk: Plaintiff's Exhibit Number 13 is marked in evidence.

(Plaintiff's Exhibit No. 13 was received in evidence.)

By Mr. Kendrick:

Q. Inviting your attention to plaintiff's exhibit 10-A for identification, would you tell the Court what is depicted thereon?

A. This is a photograph of a typical selection of the types of products which we manufacture for the aero-

space industry showing the approximate range of size, from the largest to the smallest, and the varieties of configurations.

The Court: Those are in accordance with your device as shown in the application?

The Witness: Yes, Your Honor.

The Court: All right.

Mr. Kendrick: I offer it in evidence, Your Honor.

The Court: It may be received. Mark it.

The Deputy Clerk: Plaintiff's Exhibit 10-A is marked [134] in evidence.

(Plaintiff's Exhibit No. 10-A was received in evidence.)

Mr. Kendrick: If Your Honor please, this morning we had testimony regarding plaintiff's exhibit 11-C and 12, the AiResearch Manufacturing Company's request for quotation and the survey study. We would like to offer those in evidence.

The Court: Have you seen these?

Mr. Cochran: Yes, sir. I have seen those. In view of your ruling on the letter, I have no objection on these, sir.

The Court: Very well then. For the same reason, they are received in evidence. Mark them.

The Deputy Clerk: Plaintiff's Exhibits 11-C and 12 are marked in evidence.

(Plaintiff's Exhibits No's. 11-C and 12 were received in evidence.)

Mr. Kendrick: And lastly, we think we ought to show the home of the Eckel Valve, a rather small plant in California, just to show that it isn't a big industry.

The Court: Well, that is a very nice section of California. I don't see any reason why it ought to be objected to.

By Mr. Kendrick: [135]

Q. Could you identify plaintiff's exhibit 17, please?

A. Yes. These are photographs of my small factory.

Mr. Kendrick: We would like to offer that in evidence, Your Honor.

The Court: Very well.

The Deputy Clerk: Plaintiff's Exhibit 17 is marked in evidence.

(Plaintiff's Exhibit No. 17 was received in evidence.)

Mr. Kendrick: I have no further questions, Your Honor.

The Court: You have one more witness, haven't you?

Mr. Kendrick: No, Your Honor.

The Court: This is your last witness?

Mr. Kendrick: This is the last witness.

The Court: All right.

Mr. Kendrick: And we would like to also offer plaintiff's exhibit 8 for identification in evidence, which is the sketch about which Dr. Mauritz testified, and plaintiff's exhibit 20 for identification in evidence, which is an enlargement of the Patent Office drawing, about which Dr. Mauritz testified.

The Court: The Clerk will mark them in evidence.

The Deputy Clerk: They were marked in evidence [136] earlier, Your Honor.

The Court: All right.

Mr. Kendrick: Plaintiff's exhibits 1 and 11-A, are they already in?

The Deputy Clerk: Yes, sir.

Mr. Kendrick: We offer plaintiff's exhibit 14, the photograph showing the small valve in the hand.

The Court: It may be received in evidence.

The Deputy Clerk: Plaintiff's exhibit 14 is already marked in evidence, Your Honor.

Mr. Kendrick: We would like to make a general offer of all of the exhibits, Your Honor. I don't believe we have missed any.

The Court: I don't think you have, but you had better check on them.

You may start your cross-examination, Mr. Cochran.

Cross Examination

By Mr. Cochran:

Q. Mr. Eckel, at what time did you first develop a valve which corresponds to the claims that you seek in your application?

The Court: Do you mean when he finished the development or began work on the development of the valve? Do you mean when did he complete the development? [137]

Mr. Cochran: Yes, sir.

By Mr. Cochran:

Q. At what time did you complete the development of it to the point where you thought you had an operative device?

A. I have nothing with me to refresh my memory, sir, but I will tell you that it was prior to the date on the AiResearch request for a quotation and it was following the date of the Saval survey report. I can do no better from memory. I would have to check the records.

Q. That will be sufficient. When did you first hear of the Gachon patent?

A. I first heard of it when it was called to my attention by the Patent Office, sir.

Q. During the prosecution of your application, is that correct?

A. That is correct, sir.

Q. How about the Fuscaldo patent? When did you first hear of that?

A. When it was called to my attention by the Patent Office.

Q. A number of the valve exhibits in evidence, for example, exhibit 3-A, include on them the words "Patents Pending". What is the significance of that?

A. It means when I manufactured these articles I applied [138] for a patent and thereafter marked them patents pending.

Q. What is the significance of the plural of the word patent; did you have more than one application?

A. Yes. Some have been granted on this type of product.

Q. You have been granted patents on this type of product?

A. That is correct.

Mr. Cochran: That is all I have, Your Honor.

The Court: You have no redirect, I assume?

Mr. Kendrick: No, Your Honor?

The Court: Do both sides rest?

Mr. Kendrick: Yes, Your Honor.

Mr. Cochran: Yes, Your Honor.

The Court: This has been a very interesting case, and the Court is not at all prepared to render a judgment at this time. So it is going to take the decision under advisement. And instead of listening to oral arguments the Court will be much more pleased with briefs from the parties.

How much time, Mr. Kendrick, after you receive the transcript will you need for your brief?

Mr. Kendrick: Two weeks would be adequate, Your Honor.

The Court: How about you, Mr. Cochran?

Mr. Cochran: An equal time, Your Honor. [139]

The Court: After you receive a copy of Mr. Kendrick's brief?

Mr. Cochran: Yes, Your Honor, after I receive a copy of his brief.

The Court: Mr. Kendrick, if you desire to reply to anything that is in the brief of the defendant you may apply to the Court and I will give you sufficient time to do it.

Now, in addition to your briefs, I would like each side to present to the Court proposed findings of fact, conclusions of law and an order.

It has been a very interesting case, gentlemen, and nicely tried too. I congratulate you both.

Mr. Kendrick: Thank you, Your Honor.

Mr. Cochran: Thank you, Your Honor.

The Court: Court now stands adjourned until return of Court.

The Deputy Marshal: This Honorable Court now stands adjourned until return of Court.

(Whereupon, at 2:07 p.m. the trial of Civil Action No. 153-63 was concluded.)

CERTIFICATE

April 22, 1964.

The undersigned certifies the foregoing 140 pages constitute the official transcript.

Jack Maher
Court Reporter
U.S. District Court. [140]

PLAINTIFF'S EXHIBITS.

No. 1

File Wrapper and Contents of Application for
Patent.

Serial No. (Series of 1948). 661837.

Division No. 39.

Filed complete (Date) May 27, 1957.

Serial No. 661 837.

Applicant(s). Eckel, Vincent W. of Northridge, Calif.

Title of invention. Solenoid Operated Actuator and
Valve.

Sh. drw. 1

Filing fee. \$30.

Transaction 51229.

Atty's docket 93/262.

This is to certify that annexed hereto is a true copy
from the records of the United States Patent Office of
File Wrapper and Contents of the file identified above.

By authority of the
Commissioner of Patents
/s/ M. G. LANHAM JR.
Certifying Officer

Date December 31, 1964.

Specification.

To All Whom It May Concern:

Be it Known That I, Vincent W. Eckel, a citizen of the United States of America, residing at Northridge, in the County of Los Angeles, State of California, have invented a new and useful

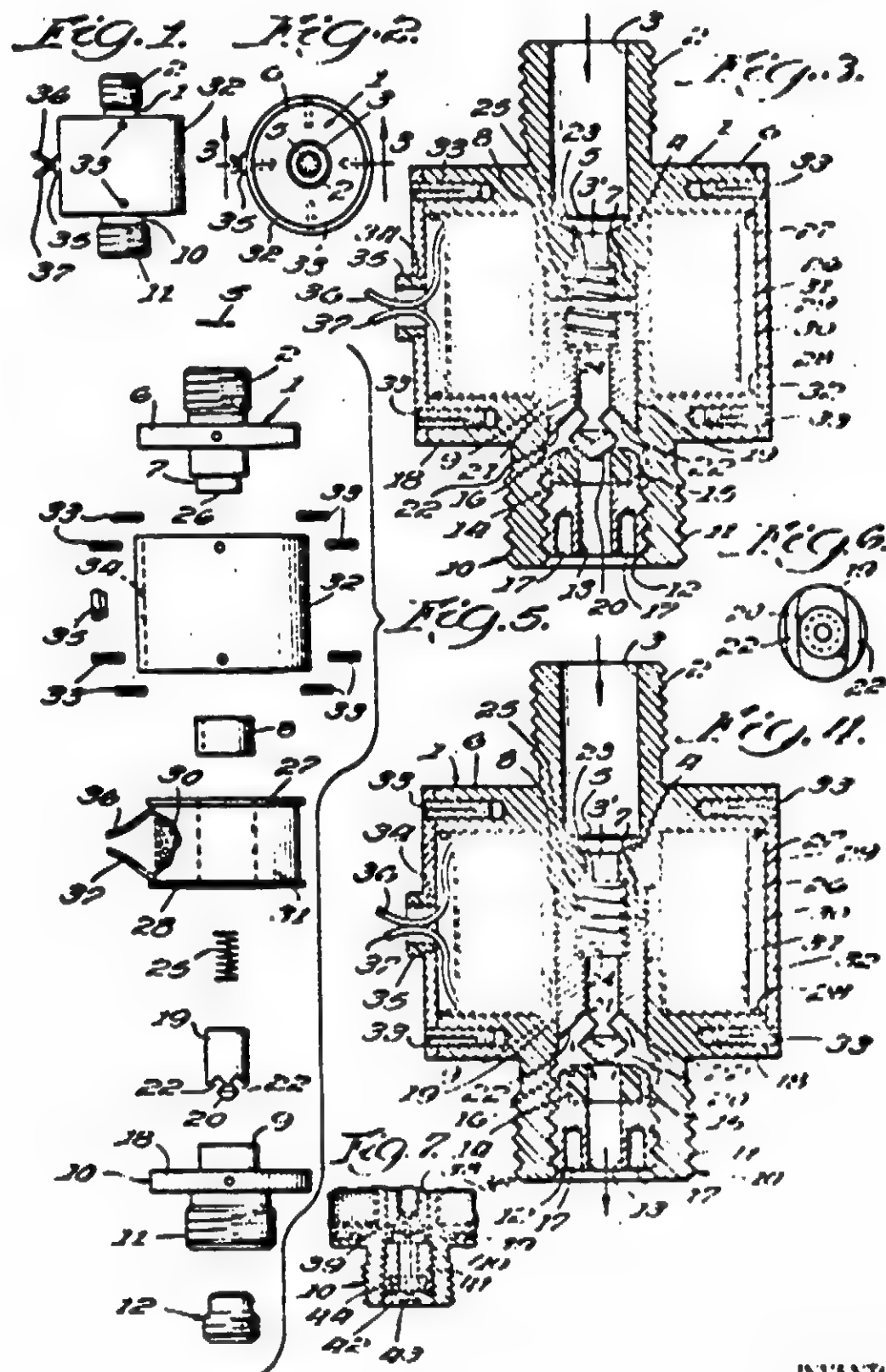
SOLENOID OPERATED ACTUATOR AND VALVE

of which the following is a specification:

The present invention relates to improved electromagnetic structures useful as electrical operators for valves. The present application is a continuation in part of my application S.N. 267,178, filed January 18, 1952.

A great number of solenoid operated valves are employed in aircraft and for that purpose the valves must be of light weight and must operate with a minimum of current. By way of example, the best valves in these respects heretofore available for a given use weigh about five and three quarter ounces. In accordance with the present invention, the valves are made much smaller and operate with a relatively small amount of current.

Briefly, the arrangements described herein involve an electromagnetic operator which includes a coil and an open-end magnetizable structure having spaced pole pieces extending within the axial limits of the coil and a plunger slidably mounted on said structure without substantially any air gap between the magnetizable structure and the plunger and with a portion of the plunger being disposed between such pole pieces when the coil is energized. By this expedient there is effectively only one air gap, i.e., working gap, within the axial limits of the

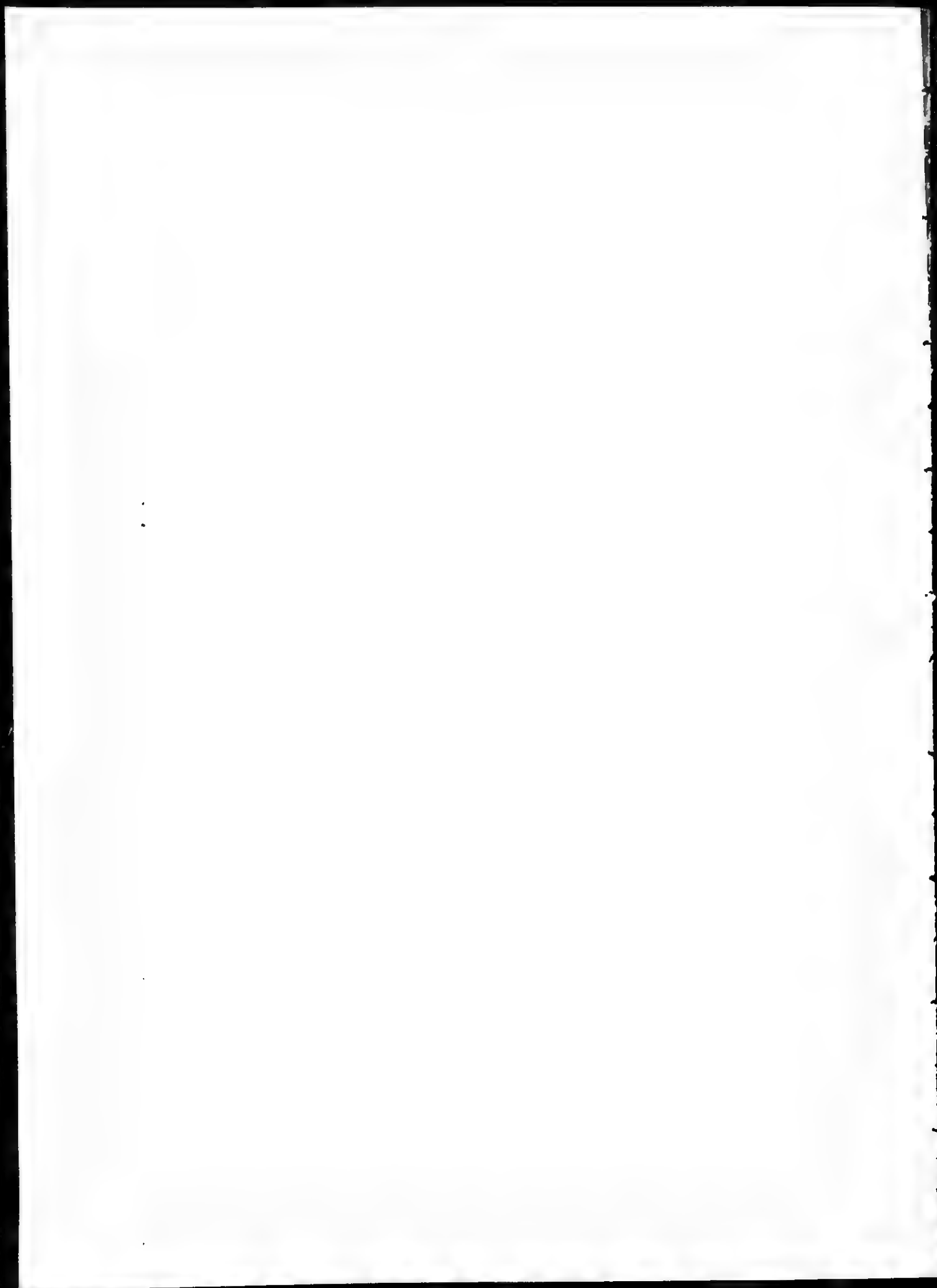


INVENTOR
VINCENT W. ECKEL

BY

Lyon & Lyon

ATTORNEYS



coil, and when the coil is energized, the plunger bridges the gap between such pole pieces and is in intimate engagement with the same so that there is substantially no air gap in the energized condition of the coil.

In general, the following factors contribute materially to the efficiency of the arrangement, namely, (1) instead of providing a nonmagnetic guide tube for the plunger, a portion of the magnetizable structure extends within the axial confines of the coil and is used as a guide for the plunger without substantially any air gap between the plunger and the portion on which it is guided; (2) the only effective air gap or working gap that exists in the de-energized condition of the coil is a gap between, on the one hand, a portion of the plunger and, on the other hand, a portion of the magnetizable structure which also extends within the axial confines of the coil; and (3) when the coil is energized, the plunger is in intimate engagement with spaced pole pieces of the magnetizable structure so that in this condition there is substantially no air gap in the magnetic flux path. Preferably, as shown, the working gap defined by a pole piece and the plunger is located at or near the transverse center line of the coil so that the working gap is disposed substantially at the point of greatest flux intensity. The result of this construction is that for a given tractive effort desired or required, a much smaller and lighter coil is employed.

An object of the present invention is to provide a solenoid powered operating means which is particularly useful for operating valves for the control of fluid flow which is so constructed and arranged as to make efficient use of the magnetic flux developed by a solenoid coil.

Another object is to provide an improved electromagnetic structure in which the armature comprises the valve element and which armature is of light weight and having the mass thereof so distributed and arranged as to efficiently respond to the flux developed by the coil with resultant reduction in the weight and size of the coil and valve and in the current required for its operation.

Another object of the invention is to provide a valve in which the foregoing objective is realized and which valve is composed of few parts all of simple construction, which is readily assembled and which is reliable in operation.

Another object of the present invention is to provide an improved electromagnetic operator which includes a coil and an associated magnetizable structure having a portion thereof which extends within the axial limits of the coil and serves as a guide for an associated plunger without substantially any air gap between the plunger and such portion in all positions of such plunger.

Another object of the present invention is to provide an electromagnetic operator which includes a coil and a magnetizable structure which has spaced pole pieces both of which are disposed within the axial limits of the coil to define an air gap at or near the transverse center line of the coil and with a plunger slidably mounted on one of such pole pieces without substantially any air gap between the plunger and such pole piece on which it is slidable, and, further, with a portion of the plunger in the de-energized condition of the coil being positioned between such pole pieces.

Another object of the present invention is to provide an operator as set forth in the preceding paragraph in

which the plunger is in intimate engagement with both pole pieces when the coil is energized so that a continuous flux path of paramagnetic material exists at that time.

The features of the present invention which are believed to be novel are set forth with particularity in the appended claims. This invention itself, both as to its organization and manner of operation, together with further objects and advantages thereof, may be best understood by reference to the following description taken in connection with the accompanying drawings in which:

Figure 1 is a side elevation of a valve embodying the present invention.

Figure 2 is a top plan view of the valve shown in Figure 1.

Figures 3 and 4 are enlarged medial sectional views taken on the line 3-3 of Figure 2 and showing the valve in closed and open positions, respectively.

Figure 5 is an exploded view of the component parts of the valve shown in the preceding views.

Figure 6 is an enlarged end elevation of the valve seat engaging end of the valve element.

Figure 7 is a fragmentary, transverse sectional view showing a modification adapting the invention to a normally open valve.

Referring to Figures 1 to 6 of the drawings, the illustrated embodiment of the invention comprises inlet member 1 of circular form and having an outer hollow threaded portion 2 adapted for connection to a fluid conduit. The member 1 is provided with an axial bore 3' which is restricted as at 3' at the inner end thereof; the

junction of the bores 3 and 3' forming a shoulder 4 on which a screen 5 is positioned. At about its midlength, the inlet member 1 is provided with an annular flange 6 which provides one end wall of the coil carrying surface as will be later described in detail. The inlet member is formed of magnetizable or paramagnetic material and the inner end of the member is reduced in diameter as at 7 to provide a seat for one end of a sleeve 8 of nonmagnetic material which is brazed or soldered to the inlet member to provide a fluid tight joint. The opposite end of the sleeve 8 is soldered or brazed in abutment to the inner end or pole piece 9 of a circular outlet member 10 also formed of magnetizable or paramagnetic material and disposed in axial alignment with the inlet member 1 and the sleeve 8. The outer end 11 of the outlet member 10 is externally threaded to afford means for connection to the fluid conduit in which the valve is installed, and is also internally threaded for adjustable reception of a screw threaded plug 12 having an axial bore 13 therethrough and at its inner end carrying an annular valve seat member 14 preferably formed of a non-metallic material. In the illustrated embodiment, the valve seat member is formed of a ring of a plastic material known as "Teflon" seated in a counterbore 15 in the inner end of the screw plug 12 and the end of the screw plug is spun into a groove 16 formed in the outer edge of the valve seat member as best shown in Figures 3 and 4. The outer end of the screw plug 12 may be provided with suitable means to rotate it in the outlet member 10 incident to assembly and adjustment axially of the outlet member 10, here comprising a pair of holes 17, 17 adapted for engagement by a suitable spanner wrench. The outlet member 10 at its midlength is

further provided with an integral annular flange 18 which provides the opposite end wall of the coil carrying surface; and, the outer peripheries of the inner ends of the inlet and outlet members and the sleeve 8 are of uniform size and complete the coil carrying surface.

The inner surfaces of the inner end of the outlet member 10 and the sleeve 8 are coaxially disposed and are of the same size and combine to form a guide for a movable armature or valve member 19 formed from magnetizable or paramagnetic material and which is circular in cross section and only sufficiently smaller in diameter than the said inner surfaces of the outlet member 10 and sleeve 8 to be freely movable endwise therein. The valve member 19 at the end thereof disposed toward the outlet member is provided with a frusto conical end face 20 engageable with the adjacent end of the valve seat member 14 and further is provided with an axial bore 21 extending from the end thereof adjacent the inlet member 1 to a point adjacent the conical face 20. Oppositely disposed saw slots extending angularly inward from points outwardly adjacent the end face 20 intersect the inner end of the bore 21 and form ports 22, 22 through which fluid entering the bore 21 may exit from the valve member 19. The adjacent ends of the bore 3' in the inlet member 1 and the bore 21 in the valve member 19 are of the same size and are in axial alignment and are provided, respectively, with aligned counterbores 23 and 24 which provide housing and seating for a compression coil spring 25 constantly effective to urge the valve member 19 into engagement with the valve seat member 14 (see Figure 3). As best shown in Figures 3 and 4, the valve element 19 extends for the major portion of its length along the inner face

of the outlet member and for a minor portion of its length along the parallel inner face of the sleeve 8; the movement of the valve member to the open position being limited by the inner end or pole piece 26 of the inlet member and the extent of movement of the valve member being only sufficient to allow fluid flow past the valve seat through an area which is at least as great as the bore 13.

In assembly, the inlet and outlet members 1 and 10 and the interposed sleeve 8 are first united to form an integral valve body structure with the flanges 6 and 18 and the portion of the body between said flanges forming a coil receiving space. The inner faces of the flanges and the coil carrying portion of the valve body are then provided with insulating washers 27 and 28 and an insulating sleeve 29 respectively and a solenoid coil 30 is then wound in place thereon and covered by an insulating sleeve 31. The coil is housed by a magnetizable or paramagnetic metal sleeve 32 closely fitting over the flanges 6 and 18 and secured thereto by screws 33; said sleeve having an opening 34 in one side thereof carrying a bushing 35 through which the leads 36 and 37 of the coil 30 extend for connection to a source of electrical energy which in this case is a DC source.

In operation, the valve is held normally closed by the action of the spring 25 assisted by the pressure of the fluid. When the coil 30 is energized, the magnetic flux generated thereby moves from the midlength of the coil in a generally toroidal path along the inner end of the inlet member, thence outwardly through the flange 6, thence along the sleeve 32 to the flange 18, thence inwardly along said flange 18 to the inner end of the outlet member 10 and thence along said inner end until

interrupted by the nonmagnetic sleeve 8. The valve element or armature 19 being of paramagnetic material and in close contact with the bore of the inner end of the outlet member and extending closer to the inner end 26 than the inner end of the outlet member, provides an easier path for the flux to follow than through or around the sleeve 8, with the result that the flux flow is bypassed through the sleeve 8 and is concentrated between the closely adjacent ends of the valve member 19 and the inlet member causing the valve member to be drawn toward the end of the inlet member permitting fluid flow through the inlet member thence into the bore 21 of the valve member and the ports 22, 22, and thence through the outlet member so long as the coil is energized. Upon de-energization of the coil 30, the spring 25 will move the valve 19 to closed position.

The efficient and concentrated use of the magnetic flux between the poles represented by the adjacent and normally slightly separated ends of the valve member 19 and the inlet member 1 reduces the size of the coil required to effect movement of the valve, and the smaller coil, in turn, enables a shorter and lighter valve element to be employed with resultant creation of a smaller and lighter valve for a given duty than has heretofore been achieved.

By way of example, a valve embodying the present invention and having the same capacity and current consumption, and designed for the same duty as the prior art valve heretofore mentioned, weighs only about one and three quarter ounces.

Referring next to Figure 7, there is shown a modification by which the invention may be adapted for use as

a normally open valve which is moved to closed position by energization of the solenoid coil. In the modification, the valve element 19 is replaced by valve assembly comprising a reciprocable armature component 38 formed of magnetizable or paramagnetic material movable in the space formerly occupied by the valve element 19. The armature 38 has an axial bore 38' terminating in ports 39, 39 at the discharge end and also has an annular flange portion 40 engageable with the adjacent end of the valve seat holding member 41 which is threaded into the end of the outlet member 10 to limit the extent of movement of the valve assembly in one direction. The valve seat member 41 at its outer end carries a valve seat element 42 engageable by the conical head 43 of the valve component of the valve assembly which is secured to the armature component by an integral stem portion threaded into the armature component; it being understood that the valve seat is so adjusted longitudinally of the outlet member that the valve will seat before the end of the armature component can engage the end 26 of the inlet member to insure proper seating of the valve. Thus when the coil is energized, the armature 38 is moved upwardly against the action of gravity and/or a biasing spring like spring 25 and the valve engages the valve seat to prevent fluid flow; and when the coil is de-energized, the spring 25 moves the valve to open position. Thus, by the substitution of the valve and valve seat elements, the assembly may be formed as a normally open or normally closed valve.

Additionally, it will be obvious from the constructions shown that the invention has usefulness as a solenoid powered operator for devices other than valves, since,

for example, in place of the valve head on the stem 44, the stem may be adapted for connection to other devices to be actuated such as, for example, a relay. Other examples of mechanism capable of such actuation are detents or ratchet mechanisms.

It will be seen from the above constructions that the sleeve 8 of nonmagnetizable material, besides serving as a convenient fastening element for maintaining the spool elements 1 and 11 in spaced relationship, serves also as a means for effectively establishing an air gap between the elements 1 and 11 and, more specifically, between the spaced pole pieces 26 and 9 of elements 1 and 11, respectively. While provision of such nonmagnetic sleeve 8 is preferred for mechanical assembly purposes, such nonmagnetic sleeve 8 may be omitted for purposes of obtaining the desired flux paths instrumental in moving the plunger 19 as previously described. In other words, so far as the magnetic behavior of the structure described is concerned, it is immaterial as to whether the nonmagnetic sleeve 8 is or is not present. When the nonmagnetic sleeve 8 is not present, the elements 1 and 11 are maintained, for example, in their spaced relationship shown in Figure 3 by a preformed spool on which the coil is wound. In such latter case, the element 11 of magnetizable material provides the sole means (instead of a supplementary means) whereby the plunger is guided in its movement without substantially no air gap between the plunger and the element 11 in all positions of the plunger.

It will be seen from these constructions that a magnetizable structure involving elements 1, 11 and 32 is provided having spaced pole pieces 26 and 9, both of which extend within the axial limits of the coil 30 so as

to define a working gap within the confines of such coil and at any region which is generally at or near the transverse center line of the coil 30. Further, it will be noted that there is only one air gap in the de-energized condition of the coil and such air gap is defined, on the one hand, between the plunger 19 and the pole piece 26; and, further, when the coil 30 is energized, the plunger 19 is in intimate engagement with both pole pieces 26 and 9 so that in this condition there is a continuous magnetizable flux path established whereby the current producing such flux may be indeed quite small.

While in some forms of the invention, the use of a biasing spring 25 is preferred, for purposes of biasing the plunger or armature away from its attracted position, such spring in other forms of the invention may be omitted and the biasing force for the same purpose may be provided by other means such as, for example, the weight of the plunger and/or the force asserted by the fluid on the plunger.

While the particular embodiments of the present invention have been shown and described, it will be obvious to those skilled in the art that changes and modifications may be made without departing from this invention in its broader aspects and, therefore, the aim in the appended claims is to cover all such changes and modifications as fall within the true spirit and scope of this invention.

Claims.

1. An electromagnetic operator comprising a coil, an open ended magnetizable structure magnetically associated with said coil and having spaced pole pieces thereof each within and defining an air gap centrally located within the confines of the coil, said pole pieces extending into opposite ends of said coil, and a plunger slidably mounted on said structure without substantially any air gap between the same, one of the said pole pieces serving as a stop for said plunger when energized said plunger bridging said air gap when said coil is energized, said plunger having a substantial portion thereof disposed within the space defined by said air gap when said coil is deenergized.

2. An electromagnetic operator including a coil, an open ended magnetizable flux path structure partially encircling said coil with the open ends thereof both extending into opposite ends of said coil and being within the axial limits of the coil and with said ends being spaced from each other, a magnetizable plunger, said structure serving as a stop for said plunger when energized, said structure being engaged by said plunger to provide a guide therefor without substantially any air gap between the same, said plunger having a surface which engages a surface of one of said open ends when said coil is energized, said plunger surface being completely within the confines of said coil when said coil is deenergized.

3. An operator as set forth in Claim 2 in which said plunger has its end disposed between said open ends when said coil is de-energized.

4. An operator as set forth in Claim 3 in which said plunger bridges said open ends when said coil is energized.

5. An electromagnetic operator comprising a coil, a magnetizable structure magnetically associated with said coil and including a pair of pole pieces each of which are within the confines of the coil and which are spaced to effectively define an air gap centrally located within the confines of said coil, said pole pieces extending into opposite ends of said coil, a plunger, said plunger being slidably mounted on one of said pole pieces without substantially any air gap between the same and with said one pole piece serving as a guide for said plunger, said plunger being movable into engagement with the other pole piece when said coil is energized to bridge said air gap, said plunger having a substantial portion thereof disposed within the space defined by said air gap when said coil is deenergized.

6. An electromagnetic operator comprising a coil, a magnetizable structure including: a pair of spaced pole pieces extending into opposite ends of said coil and spaced from each other, a magnetizable flux path structure extending exteriorly of said coil and interconnecting said spaced pole pieces, a magnetizable plunger in slidable engagement with one of said pole pieces and having a portion thereof in the spacing between said spaced pole pieces and spaced from the other pole piece when said coil is de-energized, said plunger being moved into engagement with said other pole piece when said coil is energized.

7. In a solenoid type actuator, a spoollike coil-holding element, a solenoid coil mounted on said element, said coil-holding element comprising a first end member

formed of paramagnetic material and including a portion extending into one end of said coil and serving as a fixed pole, said first end member having a coil engaging flange, a second end member formed of paramagnetic material and including a portion extending into the opposite end of said coil, said second end member having a coil engaging flange, the adjacent ends of said members within said coil being spaced from each other, an element of paramagnetic material disposed exteriorly of said coil and interconnecting said flanges, a bore extending axially of said second end member from the end thereof within said coil towards the opposite end of said member, a nonmagnetic sleeve centrally disposed within said coil, said sleeve having one end thereof engaging the end of said second member within said coil, the opposite end of said sleeve engaging the end of the portion of said first member within said coil, opposite ends of said sleeve being united to the end portions of said first and second members with resultant formation of said spool-like element, a paramagnetic armature slidably mounted in and closely engaging the wall of said bore, said plunger, in the de-energized condition of said coil, being spaced from said portion of said first end member with resultant formation of a working gap between said fixed pole and the adjacent end of said armature with a substantial portion of said armature being located within the axial limits of said sleeve when said coil is deenergized, said coil upon being energized being effective to move said armature into engagement with said fixed pole while maintaining said close sliding engagement with the wall of said bore with resultant creation of a closed flux path extending entirely through paramagnetic material including said end members, said flange

interconnecting element and said armature and with the flux having its greatest intensity substantially in the plane of contact of said armature and said fixed pole.

8. In a solenoid type actuator, a body structure having a bore therein, said body structure supporting a solenoid coil disposed exteriorly and coaxially of said bore, the inner end of said bore terminating within the axial limits of said coil and said body structure being formed of paramagnetic material except for a section of nonmagnetic material disposed substantially within the axial limits and centrally thereof, said body structure further including an end member extending within the axial limits of said coil and terminating near said nonmagnetic section and constituting a pole piece of the solenoid, a paramagnetic element slidably mounted in said bore and constituting an armature of said solenoid, said armature being movable in said bore into and out of engagement with said fixed pole piece, said armature having a substantial portion thereof disposed within said axial limits when said coil is deenergized.

9. In a solenoid operated valve, a valve body structure having a passage therein, said body structure supporting a solenoid coil disposed exteriorly and coaxially of said passage, said body structure being formed of paramagnetic material except for a tubular section of nonmagnetic material disposed substantially within and centrally of the axial limits thereof and forming a portion of said passage, the ends of said tubular section being both within the confines of the coil, said body structure further including an end member extending within the axial limits of said coil and terminating at said nonmagnetic section and constituting a fixed pole piece of the solenoid, a valve seat at the other end of said

passage, a paramagnetic closure member engagable with said fixed pole pieces when energized and having a flow passage therein mounted for reciprocation in said passage and constituting a movable pole piece of said solenoid, said closure member having a substantial portion thereof lying within the axial limits of said tubular section of nonmagnetic material.

10. In a solenoid type actuator, a sleeve formed of nonmagnetic material, a first body member formed of paramagnetic material including a coil supporting portion disposed in axial alignment with and attached to one end of said sleeve, said first body member including a coil end covering flange at the opposite end of said cylindrical portion, said end being attached to said sleeve and serving as a fixed pole element which extends within the confines of the coil, a second body member formed of paramagnetic material having a tubular portion disposed in axial alignment with and attached to the other end of said sleeve and having a coil end covering flange at the other end of said portion, an axially disposed bore extending through said second body member and communicating with the inner diameter of said sleeve, the inner end of said bore terminating within the confines of the coil a solenoid coil encircling the combined exteriors of said sleeve and said cylindrical portions, a coil cover member of paramagnetic material engaging said flanges, a paramagnetic armature mounted in and closely slidably engaging the wall of said bore in said portion of said second body member, and having a substantial portion thereof engageable with said fixed pole element, said coil upon being energized being effective to move said armature toward and into engagement with pole, said portions, flanges, cover and armature forming a

continuous closed circuit of paramagnetic material for the flux created by the energization of said coil, said armature having said substantial portion thereof disposed within the axial limits of said sleeve when said coil is de-energized.

11. A solenoid valve including a solenoid coil, fluid conduit means extending axially through and supporting said coil comprising axially aligned tubular paramagnetic end elements with an interposed, axially aligned, non-magnetic sleeve element united to the ends of said elements, each end of said sleeve element being within the confines of the coil, one of said end elements having the end face thereof united to said sleeve and extending radially inwardly of the inner periphery of said sleeve and forming a fixed pole, a valve seat in the other of said end elements, a paramagnetic armature serving as a valve closure element disposed in said fluid conduit means and reciprocable therein between said fixed pole and said valve seat and engagable with said fixed pole when energized, said armature having close sliding engagement with said other end element at all times, paramagnetic means connecting said end elements and housing all exterior surfaces of said coil, the working gap between said fixed pole and said armature being intersected by a plane which extends substantially transversely through the axis of said coil within approximately the middle third of said coil, said armature having a substantial portion thereof within the axial limits of said sleeve element when said coil is deenergized.

12. An electromagnetic operator comprising, a coil, an open ended magnetizable structure magnetically associated with said coil and having spaced pole pieces thereof each extending into opposite ends of said coil and being within the confines of the coil and defining an

air gap centrally within the confines of the coil and a plunger slidably mounted on said structure without substantially any air gap between the same, said plunger bridging said air gap when said coil is energized, said plunger having a surface which engages a surface of one of said pole pieces when said coil is energized, said plunger surface being completely within the confines of said coil when said coil is deenergized.

13. An operator as set forth in Claim 12 in which said plunger has a substantial portion thereof disposed within the space defined by said air gap when said coil is deenergized.

14. An operator as set forth in Claim 13 in which said plunger has all surface portions thereof that are adjacent to and are engagable with one of said pole pieces located entirely within the confines of the coil when the coil is deenergized.

15. An electromagnetic operator comprising, a coil, an open ended magnetizable structure magnetically associated with said coil and having spaced pole pieces thereof each of which extends into opposite ends of said coil is within the confines of the coil and define an air gap within the confines of the coil, and a plunger slidably mounted on one of said pole pieces without substantially any gap between the same, said plunger bridging said air gap when said coil is energized, said plunger in its deenergized condition having that portion which is located closest to an engagable surface of the other pole piece, as measured in the direction of travel of said plunger within the confines of said coil.

16. An operator as set forth in Claim 15 in which said plunger has a substantial portion thereof disposed within the space defined by said air gap when said coil is deenergized.

Paper No. 7
Received Nov. 9, 1958

IN THE UNITED STATES PATENT OFFICE
Division 39

In re application of Vincent W. Eckel Serial No.
661,837 Filed May 27, 1957 For SOLENOID OPER-
ATED ACTUATOR AND VALVE.

Amendment.

Los Angeles 17, California
October 30, 1958

Commissioner of Patents
Washington 25, D. C.

Sir:

In response to the Office Action dated June 10, 1958,
kindly amend the above application as follows:

In the Claims:

Claim 1, line 5, after the comma (,) and before "and"
insert — said pole pieces extending into opposite
ends of said coil, —

Claim 2, line 4, after "both" insert — extending into
opposite ends of said coil and —

Claim 5, line 5, after the comma (,) and before "a"
insert — said pole pieces extending into opposite
ends of said coil, —

* * * *

REMARKS

This is in response to the Office Action dated June
10, 1958.

Careful consideration has been given to the Office
Action dated June 10, 1958, as well as to the prior

prosecution of this and applicant's previous application, Serial No. 267,178, and it is clear therefrom that exhaustive searches have been made through the prior art without a reference being developed showing applicant's novel construction. In the last Office Action the Examiner has cited only one more additional patent, namely the French Patent No. 876,454, and has rejected all of the claims thereon.

Applicant forwards herewith for the Examiner's kind consideration a translation of the French Patent No. 876,454 made by the Patent Office on applicant's order. This translation, as reported on page 4 thereof, has been made by J. C. Levy, 8-13-58.

This French Patent 876,454 pertains to a gas pressure regulator and for the patentee's purpose he provides an electromagnetically operated on-and-off valve. It clearly appears, for the patentee's purposes, that any electromagnetically operated on-off valve could be used. However, the structure and functioning of the electromagnetically operated valve disclosed is conjectural and is not considered to be sufficiently clear and definite to serve as an anticipation for reasons presently described.

The French patent discloses a coil 16 encased in "a rigid body 2" and the first question which arises is — how is such coil 16 placed in the rigid body 2? Perhaps such coil 16 is wound with the wires comprising the turns of the coil being threaded through an opening which is subsequently closed by a member (which is not numbered or discussed in the French patent). Such member referred to is illustrated by close line hatching with the hatch lines spaced as close as the hatch lines

representing the "movable core 17". Also, such member, for purposes of proper identification, is that one having a general T-shaped cross section in the French patent.

The "movable core 17" is undoubtedly of magnetic material; otherwise it would not be moved to valve opening position when the coil 16 is energized. The same type of hatching is used for such magnetic "movable core 17" as this unnumbered T-shaped element; and since the same type of hatching is used, the next question is — why is not such T-shaped member of magnetic material also since it is also represented by closely hatched lines? Further, upon consideration that such T-shaped unnumbered and undescribed member serves as a closure member for a winding aperture, then — why is not such T-shaped member of the same material as that body for which it forms a closure member? The "rigid body 2" is undoubtedly of magnetic material in view of the representation of a "magnetic circuit 15". It would appear that one making a closure member for that portion of the body which encloses the coil 16 would use the same material as the material forming the remaining portion of the enclosure for coil 16; and in doing so, such T-shaped member would be of magnetic material.

While the French patent does state "a magnetic circuit 15", it should be emphasized that the magnetic circuit is described as *a* magnetic circuit and does not necessarily include *all* magnetic circuits. The only specific "magnetic circuit" described by the French patentee is that circuit

which includes the magnetic core 17; and the French patent is silent with respect to other possible and probably magnetic circuits.

There should be no question in the Examiner's mind that the gas pressure regulator would operate if the unnumbered and undescribed T-shaped member were of magnetic material in view of experiments made by applicant. In such experiments applicant changed his electromagnetically operated valve as shown on his enclosed drawing AF42M-562 as indicated in red on such enclosed print which includes the notation in red "make sleeve of type 416 steel same material as end pieces". The sleeve referred to and shown in the drawings is, in applicant's production, of nonmagnetic material. The substituted sleeve of Type 416 steel is of magnetic material. Applicant has found that his valve, represented by drawing AF42M-562 in which a magnetic sleeve is substituted for a non-magnetic sleeve modified as indicated in red on the enclosed print, will operate but is unsuitable for obtaining the new results and advantages embodied in his commercial electromagnetic structures, as alluded to in the specification herein. The point is that the electromagnetic structure shown in the French patent will operate if the T-shaped member is either of magnetic or non-magnetic material but that new and improved results are obtained when, in accordance with applicant's novel teachings, his sleeve as shown and claimed herein with respect to the other structure is of non-magnetic material.

A device constructed as shown in drawing AF42M-562 but modified to include a magnetic sleeve as indicated in red on the enclosed print is at hand and will be made available for the Examiner's kind considerations if he should have any doubt that the same may be inoperative.

Also, the following should be taken into consideration in ascertaining the worth of the French patent as a reference in the instant case. The presumption is, if indeed there is such a presumption, that elements not specifically described and within a possible magnetic circuit are of magnetic material and using this presumption and other considerations mentioned above, one making a device as shown in the French patent would make the T-shaped member of magnetic material and, indeed, find the resulting structure to be operable.

* * * * *

Paper No. 10
April 15, 1960
Pat. Div. 39

U. S. DEPARTMENT OF COMMERCE

Patent Office
Washington

Lyon & Lyon
811 W. 7th St.
Los Angeles 17, Calif.

Applicant: Vincent W. Eckel.

Ser. No. 661,837.

Filed May 27, 1957.

For Solenoid Operated Actuator and Valve.

Please find below a communication from the EXAM-
INER in charge of this application.

Robert C. Watson
Commissioner of Patents.

Final Rejection.

Responsive to letter of October 22, 1959.

Claims 8-18, 10 and 12-16 are again rejected as unpatentable over Hammond or Fuscaldo in view of any one of Heinrich, Gachon or Bosch as applied in the previous Office action dated May 25, 1959. Applicant's remarks regarding the Hammond reference have been carefully noted but have not been convincing. In modifying the Fuscaldo reference, the examiner intended that pole member 2 be extended into the coil. Of course when pole member 2 is extended, the non-magnetic sleeve and magnetic pole piece 4 will be reduced an equal amount and the armature 5 will be repositioned. It is also pointed

out that whether the air gap is at one end of the winding or is at the center of the winding is only a matter of choice since the device will function as efficiently from one position as from the other position. Applicant's remarks regarding the winding of the coil 30 are not understood since such coils are normally wound independently of the non-magnetic sleeve and inserted on the non-magnetic sleeve and housing structure after having been wound.

Claims 1-8, 10 and 12-16 are again further rejected and claims 9 and 11 are again rejected as unpatentable over Gachon as applied in the previous Office action dated May 25, 1959. When the examiner stated that the electromagnet would be short circuited, he meant that the main lines of current flux from the coil would flow through the complete magnetic housing and bypass the plunger except for a little leakage flux. This would cause the solenoid coil to use a great amount of current and do very little work. In other words, if the T-shaped member is made of magnetic material, the solenoid would be about as inefficient as it would be possible to make a solenoid. Furthermore, if the T-shaped member were made of magnetic material there would be no reason for Gachon to show the T-shaped member as a member separate from the other housing structure.

This action is made *FINAL*.

/s/ I. WEIL
Examiner

J.T.D.
JTDeaton:lw

Paper No. 11
Received June 22, 1960

IN THE UNITED STATES PATENT OFFICE
Division 39

In re application of Vincent W. Eckel, Serial No. 661,837. Filed May 27, 1957. For Solenoid Operated Actuator and Valve.

Affidavit of Vincent W. Eckel.

State of California, County of San Luis Obispo—ss:

Vincent W. Eckel, after being duly sworn, deposes and states that:

1. He is the applicant in the above entitled application.
2. He has read the Office Action dated April 15, 1960 and particularly the sentence therein reading as follows: "It is also pointed out that whether the air gap is at one end of the winding or is at the center of the winding is only a matter of choice since the device will function as efficiently from one position as from the other position."
3. He disagrees with the conclusion stated in such sentence in that the location of the air gap in the structures shown in his above entitled patent application is important and involves more than a matter of choice since the devices disclosed herein function more efficiently when the air gap is centrally located within the coil.

4. He makes these statements based on tests made some years ago in which he found that the flux density is at a maximum inside the coil at a region located at the midpoint of the coil. Thus, his device operates most efficiently when the air gap is located centrally in the coil as shown, for example, in Figure 4 in his above entitled application.

/s/ VINCENT W. ECKEL
Vincent W. Eckel

Subscribed and Sworn to Before me this 8th day of June, 1960.

Antonio F. Silveria
Notary Public in and for said County
and State

(Seal)

Lyon & Lyon
811 W. 7th St.
Los Angeles 17, Calif.

U.S. DEPARTMENT OF COMMERCE
Patent Office
Washington

Paper No. 13
Mailed July 1, 1960
Pat. Div. 39

Applicant: Vincent W. Eckel
Ser. No. 661 837
Filed May 27, 1957
For Solenoid Operated Actuator and Valve

Please find below a communication from the
EXAMINER in charge of this application.

/s/ Robert C. Watson
Commissioner of Patents.

Examiner's Advisory Action.

Responsive to amendment of June 17, 1960.

The proposed amendment filed June 17, 1960 has not been entered since it does not place the case in condition for allowance, but such amendment may be entered for the purpose of appeal upon the filing of an appeal.

If the proposed amendment were normally in the case, the following action would result.

Claim 1-16 would be rejected on the same references as applied in the previous Office action dated April 15, 1960.

The examiner's statement, "It is also pointed out that whether the air gap is at one end of the winding or is at the center of the winding is only a matter of choice since the device will function as efficiently from one position as from the other position.", is withdrawn in view of applicant's affidavit filed June 17, 1960. This argument is immaterial and unnecessary since some of the applied references show and teach the use of the air gap at the center of the coil such, for example, as the Bosh and Gachon references. The Hammond reference shows the air gap substantially centrally located.

Applicant is advised that the statutory period for response to this action runs from the date of the final rejection and expires October 17, 1960.

/s/ M. C. NELSON
Examiner

J.T.D.

JTDeaton:ms

Paper No. 14
Received August 11, 1960
Div. 39

IN THE UNITED STATES PATENT OFFICE

In re application of Vincent W. Eckel, Serial No. 661,837. Filed May 27, 1957. For Solenoid Operated Actuator and Valve.

Notice of Appeal.

Los Angeles 17, California
August 5, 1960

Commissioner of Patents
Washington 25, D. C.

Sir:

Applicant hereby appeals from the Final Rejection dated April 15, 1960 and from all grounds on which such Final Rejection is based.

Our check No. 8398 in the amount of \$25.00 to cover the appeal fee is enclosed.

Respectfully submitted,

/s/ LYON & LYON
Lyon & Lyon
Attorneys for Applicant

FEMauritz/B

IN THE UNITED STATES PATENT OFFICE
BEFORE THE BOARD OF APPEALS

Appeal No. 38,512

Division 39

In re application of Vincent W. Eckel. Serial No. 661,837. Filed May 27, 1957. For Solenoid Operated Actuator and Valve.

Applicant's Brief on Appeal.

The claims on appeal are as follows and include those amendments submitted on June 17, 1960:

* * * * *

STATEMENT OF INVENTION

The invention involves a solenoid operated valve featured by its solenoid construction exemplified in Figure 3. The armature 19 comprises a part of the valve 20, 16 and cooperates magnetically with a magnetic structure which includes: the coil 30, the inlet member 1 and outlet member 10 and the sleeve 32, the latter three elements being of magnetizable material. The inlet member 1 extends inwardly of the coil 30 to provide the pole piece 7; and likewise the outlet member 10 extends inwardly of the same coil 30 to provide the pole piece 9 to provide a magnetizable air gap located substantially midway between the ends of coil 30. While the sleeve 8 is shown between these pole pieces the same is of *non-magnetic* material and is used for mechanical purposes only, not magnetic purposes; and this is in accordance with the specification which recites that the non-magnetic sleeve 8 is equivalent to a magnetic air gap. The invention in its broader aspects may then be considered with the sleeve 8 omitted from the structure. Located in such air

gap defined by pole pieces 7, 9 is a portion of the magnetizable armature 19 which is illustrated in its non-attracted position in Figure 3; and when the coil 30 is energized the magnetic flux in the *centrally* located air gap 7, 9 causes the armature 19 to engage the pole piece 7 to open the valve 20, 16.

In such movement of the armature 20 the same is guided by its close engagement with the outlet member 18 and particularly the inner bore of pole piece 9 *without any substantial air gap* therebetween. Thus, the only air gap in the magnetic structure is the air gap between the pole pieces 7 and 9 and the same is located in a central portion of the coil 30 for most efficient operation. See applicant's affidavit filed June 17, 1960 which the Examiner in his Office Action dated July 1, 1960 considers sufficient for establishing the fact that this particular *central location* involves more than a matter of choice.

To achieve most efficient operation at the central portion of the coil it is essential that there be no air gap between the pole piece 9 and the armature 19. The present invention thus involves two important concepts, i. e., that a portion of the armature extend in or closely adjacent the *centrally* located air gap and that the armature actually slide on a portion of one of the pole pieces without an air gap between the same such as may for example be introduced when the armature following conventional teachings slides in a nonmagnetic brass guide tube.

The new and improved results flowing from this construction are numerous, the most important being that a highly efficient electromagnetic operator is pro-

duced which because of its efficiency, i. e., small current requirements may be made small to meet miniturization requirements in aircraft. Applicant's devices as set forth in the claims on appeal have enjoyed good commercial success and others have paid tribute to the invention by copying the same. Other subsidiary new results and advantages result from the fact that no additional guide tube is used, the magnetic structure itself being inturned into the coil to provide the guide. Also as is obvious from the drawings a highly simplified construction results in which the magnetic poles pieces integrally formed with the inlet and outlet members are simply secured together by the outer magnetic sleeve 32 performing both a mechanical as well as magnetic function.

* * * * *

FUSCALDO PATENT NO. 2,297,399

The Fuscaldo patent 2,297,399 is considered pertinent by the Examiner since Fuscaldo considers it desirable that there be no air gap between his slidable armature 5 and the magnetic member 2. This feature, however, constitutes only one feature of applicant's claimed combinations. Other features of applicant's invention not disclosed, suggested or taught in Fuscaldo involve applicant's structure wherein there is a central air gap located centrally within the energizing coil. Such centrally disposed air gap in applicant's construction is provided by extending that portion of the magnetic structure on which the armature slides, around and inside the coil. The Examiner appears to fully realize this deficiency in the Fuscaldo disclosure and suggests that it would be permissible to extend Fuscaldo's magnetic member 2 around and inside the coil 30. The question arises as to

reorganization of Fuscaldo's device and within the contemplated operation of the Fuscaldo device. If Fuscaldo's member 2 is to be extended, it should first be clear that other parts should be removed to allow such extension. In this respect if a portion of the non-magnetic tube 12 is to be removed to allow such extension, then in such case the coil 30, having an unsuitable "bobbin," could not be wound unless such assumed extension of the magnetic member 2 acquired an additional function, namely, the function of serving as a part of the coil bobbin, leading to an impractical situation in assembly of Fuscaldo's device so modified. Even so, there would still exist the long air gap defined by the remaining long portion of the non-magnetic spool 12. An alternative construction, which applicant likewise considers non-permissive, would involve not only extending such members 2 around and inwardly of the coil 30 but also would involve reducing the internal diameter of the member 2 and this would necessitate decreasing the diameter of the armature 22; and further, this would involve commensurate change in dimension of the adjacent cylindrical portion of the fixed armature 4. In either case, it should be abundantly clear that applicant's own teachings are being used in the process and in no event does there result a structure in which the inwardly extending pole pieces define a centrally located air gap within the coil. It should thus be clear that the change in Fuscaldo's structure suggested by the Examiner requires not merely a change in the member 2 but requires also a change in one or more of the following elements, namely, the spool 12, the armature 22 and the armature 4, and even so, the resulting air gap between the movable and fixed armatures would not be centrally located within the coil.

* * * * *

GACHON (French) Patent No. 876,454

A translation of this French Patent No. 876,454 is in the application file.

This French Patent No. 876,454 pertains to a gas pressure regulator and for the patentee's purpose he provides an electromagnetically operated on-and-off valve. It clearly appears, for the patentee's purposes, that any electromagnetically operated on-off valve could be used. However, the structure and functioning of the electromagnetically operated valve disclosed is conjectural and is not considered to be sufficiently clear and definite to serve as an anticipation for reasons presently described.

The French patent discloses a coil 16 encased in "a rigid body 2" and the first question which arises is — how is such coil 16 placed in the rigid body 2? Perhaps such coil 16 is wound with the wires comprising the turns of the coil being threaded through an opening which is subsequently closed by a member (which is not numbered or discussed in the French patent). Such member referred to is illustrated by close line hatching with the hatch line spaced as close as the hatch lines representing the "movable core 17." Also, such member, for purposes of proper identification, is that one having a general T-shaped cross section in the French patent.

The "movable core 17" is undoubtedly of magnetic material; otherwise it would not be moved to valve opening position when the coil 16 is energized. The same type of hatching is used for such magnetic "movable core 17" as this unnumbered T-shaped element; and since the same type of hatching is used, the next question is — why is not such T-shaped member of

magnetic material also since it is also represented by closely hatched lines? Further, upon consideration that such T-shaped unnumbered and undescribed member serves as a closure member for a winding aperture, then — why is not such T-shaped member of the same material as that body for which it forms a closure member? The "rigid body 2" is undoubtedly of magnetic material in view of the representation of *a* "magnetic circuit 15." It would appear that one making a closure member for that portion of the body 2 which encloses the coil 16 would use the same material as the material forming the remaining portion of the enclosure for coil 16; and in doing so, such T-shaped member would be of magnetic material.

While the French patent does state "a magnetic circuit 15", it should be emphasized that the magnetic circuit is described as *a* magnetic circuit and does not necessarily include *all* magnetic circuits. The only specific "magnetic circuit" described by the French patentee is that circuit which includes the magnetic core 17; and the French patent is silent with respect to other possible and probably magnetic circuits.

There should be no question that the gas pressure regulator would operate if the unnumbered and undescribed T-shaped member were of magnetic material in view of experiments made by applicant. In such experiments applicant changed his electromagnetically operated valve as shown on his drawing AF42M-562 (which appears in the application file) as indicated in red on such print which includes the notation in red "make sleeve of type 416 steel same material as end pieces". The sleeve referred to and shown in the drawings is, in applicant's production, of non-magnetic

material. The substituted sleeve of Type 416 steel is of magnetic material. Applicant has found that his valve, represented by drawing AF42M-562 in which a magnetic sleeve is substituted for a non-magnetic sleeve modified as indicated in red on the enclosed print, will operate but is unsuitable for obtaining the new results and advantages embodied in his commercial electromagnetic structures, as alluded to in the specification herein. The point is that the electromagnetic structure shown in the French patent will operate if the T-shaped member is either of magnetic or non-magnetic material but that new and improved results are obtained when, in accordance with applicant's novel teachings, his sleeve as shown and claimed herein with respect to the other structure is of non-magnetic material.

Also, the following should be taken into consideration in ascertaining the worth of the French patent as a reference in the instant case. The presumption is, if indeed there is such a presumption, that elements not specifically described and within a possible magnetic circuit are of magnetic material and using this presumption and other considerations mentioned above, one making a device as shown in the French patent would make the T-shaped member of magnetic material and, indeed, find the resulting structure to be operable.

The point is that there is no express or clear teaching in the French patent that his T-shaped cross-section member should be of non-magnetic material. Without such teaching, the French patent, being a foreign patent,

cannot be used as a reference. The law on the matter is very well settled and such law appears to be very well summarized in the opinion of the District Court for the District of Columbia in *Nye v. Coe*, 53 USPQ 663, in which the following language appears:

"(3) If in order to perfect the plaintiff's device upon reading the modification lines 86 to 93, it necessitates extensive experimentation as well as genius of an inventor, the plaintiff's invention is patentable."

"(4) While a simple improvement on a patent would not, as a rule, entitle an applicant to a patent on such improvement, an improvement arrived at on a different theory, producing definitely different results, and resulting in a superior and more useful instrument, must be held to be the result of inventive genius and is patentable.

If a patentee, by a modification which is so lacking in certainty that it shows he is wandering in an unexplored field, could have barred the issuance of patents to others, recognition and reward for long and laborious effort would have been denied to many inventive genii who have contributed so much to almost every phase of human progress. The rule as to clarity, details in construction, specification of performance and results obtained, in an anticipation based upon the claims of a foreign patentee, is, and has long been, adhered to and strictly observed by our courts.

In the case of *Selectasine Patents Co. et al. v. Prest-O-Graph Co. et al.*, 267 F. 840, 842, the rule as to the efficiency of a reference upon which to predi-

cate anticipation was stated by a District Court in Oregon as follows:

'The rule is that the reference, to be sufficient upon which to predicate anticipation, "must be so clear and definite as to enable any mechanic skilled in the art to reach the patented invention certainly, directly, and without the necessity of any experiment, and this rule is enforced with peculiar strictness when the alleged disclosure is found in a foreign patent or publication." Hoskins Mfg. Co. v. General Electric Co., 212 F. 422, 429; Seymour v. Osborne, 11 Wall. 516, 555; Berry v. Wynkoop-Hallenbeck-Crawford Co., 84 F. 646, 651; Westinghouse Air-Brake Co. v. Great Northern Railway Co., 88 F. 258, 263; Consolidated Car-Heating Co. v. West End St. Ry. Co., 85 F. 662, 665.'

Again, in Davies v. Coe, 65 App. D.C. 345, 83 F. 2d 602, 603 (29 USPQ 107, 108), the Court restated the rule:

'The disclosure of a foreign patent is to be measured not by what may be made out of it, but what is clearly and definitely expressed in it. In re Ek, 57 App. D.C. 203, 19 F. 2d 677; Carson v. American Smelting & Refining Co., 4 F. 2d 463.'

In American Stainless Steel Co. v. Ludlum Steel Co., 2 Cir., 290 F. 103, 106, the Court said:

'* * * it requires more than prophecy of what may be done, or than declarations of what ought to be accomplished, to make a good *patent reference*, not to speak of *anticipation*. It is necessary to show with reasonable certainty how the desired result can be accomplished.'

In *Skelly Oil Co. v. Universal Oil Products Co.*, 31 F. 2d 427, 431 (1 USPQ 18, 22), the rule is again stated that:

'Inferences as distinguished from disclosures, especially when drawn in the light of after events, cannot be accepted as a basis of anticipation. A patent relied upon as an anticipation must itself speak.'

In *Carson v. American Smelting & Refining Co.*, 4 F. 2d 463, 465, the rule as to anticipation in a foreign patent was forcefully stated:

'A foreign patent is to be measured as anticipatory, not by what might have been made out of it, but by what is clearly and definitely expressed in it. An American patent is not anticipated by a prior foreign patent, unless the later exhibits the invention in such full, clear, and exact terms as to enable any person skilled in the art to practice it without the necessity of making experiments.'

The above precedents are quoted to illustrate how our courts have measured the claims on foreign patents set up as anticipations and references. The more the lines 86 to 93 are studied, the more one is convinced that they do not meet the tests laid down in the cases referred to."

The same considerations applicable to the French Patent 876,454 are applicable also to the disclosure in the German Patent 662,027 of Heinrich. In his discussion of the Heinrich patent, the Examiner presupposes that Heinrich discloses a "non-magnetic sleeve" but this is not clear from Heinrich's disclosure; indeed, from the following discussion, it should be more clear that the element referred to as being non-magnetic is actually magnetic. The member referred to with respect to the Heinrich patent is that member unnumbered and un-

described which has an L-shaped cross section in Figure 1 and which lies adjacent to the coil 2 *but does not completely encircle the same*. At first glance one would consider such L-shaped member to be a coil form and then presuppose that all coil forms are of non-magnetic material. Such L-shaped member, however, cannot clearly be considered to be a coil form since one purpose of a coil form is to provide protection and added insulation for the wires comprising the coil. This is not true in the Heinrich patent since the L-shaped member does not extend completely around the coil and leaves the presumably insulated wires 2 of the coil 2 free to touch the element 1. Further, close inspection of the Heinrich arrangement reveals that the vertical leg of his unnumbered and L-shaped member extends upwardly beyond the coil 2 so that the same may be engaged by the cover plate; and it would appear that upon tightening such cover plate the L-shaped member is pressed down firmly on the spaced shoulders of the two end members 1 to assure close and intimate engagement between such L-shaped member and the shoulders of the end members 1, perhaps for assuring a good and close bridging magnetic circuit between such end members 1.

Based on applicant's experiment mentioned above, the arrangement in this Heinrich patent would operate if such L-shaped member were either of magnetic or non-magnetic material. Perhaps it would be of advantage for Heinrich's purposes to have such L-shaped member of magnetic material, particularly since he is interested in providing a device in which a constant force is developed throughout the length of the armature stroke.

It is applicant's position that the T-shaped member in the Gachon disclosure is so indefinitely portrayed in the Gachon disclosure that one skilled in the art could be

justified in the conclusion that such T-shaped member is of magnetic material. The Examiner at one time appeared to doubt this in view of his statement that "to make the T-shaped member of magnetic material as suggested by applicant . . ." would cause the electromagnet to be short circuited." At an interview which was courteously granted by the Examiner, applicant's attorney sought an interpretation of this quoted portion in view of the use of the term "short circuited." Applicant considered that the use of the term "short circuited" meant that the Examiner considered the Gachon device to be inoperative if such T-shaped member were of magnetic material. For that reason, applicant's attorney demonstrated to the Examiner the operativeness of a device constructed in accordance with drawing AF42M-562. The physical model had a magnetic sleeve and was found to operate. Thus there should be no question that the Gachon device would operate if the unnumbered T-shaped member were made of magnetic material. In such case applicant's claimed structure does not result.

It is noted that the Examiner indulges in some logic as to the nature of the material comprising the T-shaped member. This fact in itself should, in view of the law expressed in *Nye v. Coe*, mentioned in the last response, be clearly indicative of the fact that the Gachon disclosure, because of its indefiniteness, cannot be used as an anticipation in the present instance, particularly so since the Gachon device would operate if the T-shaped member is either of magnetic material or of non-magnetic material. Moreover, applicant agrees with the Examiner that in some respects the Gachon disclosure is only schematic. Schematic details of an actual physical assembly can only be the subject of much

conjecture. For example, it may be explained that the coil may be threaded through the openings as mentioned previously after which the T-shaped member in the form of a multi-piece insulating member may be inserted. This, of course, is more conjecture. It is noted in this respect, however, that the French patent to Gachon is silent as to whether the unnumbered and undescribed T-shaped member is a single unitary member or comprises a plurality of parts. It is thus applicant's position that the Gachon device would operate if the T-shaped member were either of magnetic or non-magnetic material, and that in general the schematic representation by Gachon leaves too much to conjecture to constitute an anticipation for the present purposes.

BOSCH (Swiss) PATENT NO. 93,102

The disclosure in the Bosch patent pertains to an automatic regulating system in which the plunger *i* freely floats in a magnetic structure which at first glance, is superficially close to applicant's structure. The plunger *i* freely floats to achieve various degrees of conducting particles *e* for regulation purposes. In achieving these purposes, it is clear that the plunger *i* is required to be freely floating and this is clearly indicated in the drawings wherein there is a substantial air gap between the pole pieces and the plunger. As indicated previously, one feature of applicant's claims is that his plunger slides on a pole piece without substantially any air gap therebetween. Furthermore, applicant's claims are specifically limited to a structure wherein one of the pole pieces is so constructed that it operates as a stop for stopping movement of the plunger when his coil is energized. No such structure is shown in the Bosch patent.

CONCLUSIONS

The French patent to Gachon is too conjectural to provide an anticipation; and the prior art which the Examiner attempts to combine (which includes this same French patent) provides not only insufficient teachings but teachings contrary to those embodied in applicant's claimed structures. The art on electromagnetic operators is a highly developed art and the examination of the same been thorough as evidenced by the numerous disclosures drawn from the foreign art, yet none of the same considered individually constitute an anticipation. Because the art is so highly developed, it allows disclosure of some isolated features of applicant's structure. However, one should consider — who provided that structure which incorporates *all* features and in so doing produced a *clearly novel* structure which is *small, simple, efficient in electrical current requirements* and to which others have paid tribute by copying. One of the highest tributes which may be accorded an inventor is copying by others. The prior art, at best illustrates the illusory character of the invention. As Judge Learned Hand in *United Chromium, Inc. v. International Silver Co.*, 60 F. 2d 913, 916 aptly stated:

“Nothing could better prove that they had been working blindly. Chance hits in the dark will not anticipate an invention.”

The claims on appeal should be allowed.

Two extra copies of this brief are included since applicant requests an oral hearing.

Respectfully submitted,

/s/ LYON & LYON
Lyon & Lyon
Attorneys for Applicant.

FEM/mc

Paper No. 16
Mailed Jan. 4, 1961
Pat Div. 39

DEPARTMENT OF COMMERCE

United States Patent Office
Washington

Appeal No. 385-12
Before the Board of Appeals

In re application of Vincent W. Eckel. Ser. No.
661,837. Filed May 27, 1957. For Solenoid Operated
Actuator and Valve.

Lyon & Lyon for Appellant

Examiner's Answer

This is an appeal from the rejection of claims 1-16 which are finally rejected claims as modified by the amendment of June 17, 1960. No claims are allowed.

A correct copy of appealed claims 3-11, 13, 14 and 16 appears on pages 1-9 of applicant's brief. Claim 1 is correctly reproduced below due to applicant's omission of "a" after having in line 11. Claim 2 is correctly reproduced below due to applicant's inserting "end" for coil in line 12. Claim 12 is correctly reproduced below due to the misspelling of "surface" at the end of line 9 and the beginning of line 10. Claim 15 is correctly reproduced below due to applicant's omitting "is" before within in line 5.

Claim 1. An electromagnetic operator comprising a coil, an open ended magnetizable structure magnetically associated with said coil and having spaced pole pieces thereof each within and defining an air gap

centrally located within the confines of the coil, said pole pieces extending into opposite ends of said coil, and a plunger slidably mounted on said structure without substantially any air gap between the same, one of the said pole pieces serving as a stop for said plunger when energized said plunger bringing said air gap when said coil is energized, said plunger having a substantial portion thereof disposed within the space defined by said air gap when said coil is deenergized.

Claim 2. An electromagnetic operator including a coil, an open ended magnetizable flux path structure partially encircling said coil with the open ends thereof both extending into opposite ends of said coil and being within the axial limits of the coil and with said ends being spaced from each other, a magnetizable plunger, said structure serving as a stop for said plunger when energized, said structure being engaged by said plunger to provide a guide therefor without substantially any air gap between the same, said plunger having a surface which engages a surface of one of said open ends when said coil is energized, said plunger surface being completely within the confines of said coil when said coil is denenergized.

Claim 12. An electromagnetic operator comprising, a coil, an open ended magnetizable structure magnetically associated with said coil and having spaced pole pieces thereof each extending into opposite ends of said coil and being within the confines of the coil and defining an air gap centrally within the confines of the coil and a plunger slidably mounted on said structure without substantially any air gap between the same, said plunger bridging said air gap when said coil is energized, said plunger having a surface which engages

a surface of one of said pole pieces when said coil is energized, said plunger surface being completely within the confines of said coil when said coil is deenergized.

Claim 15. An electromagnetic operator comprising, a coil, an open ended magnetizable structure magnetically associated with said coil and having spaced pole pieces thereof each of which extends into opposite ends of said coil is within the confines of the coil and define an air gap within the confines of the coil, and a plunger slidably mounted on one of said pole pieces without substantially any gap between the same, said plunger bridging said air gap when said coil is energized, said plunger in its deenergized condition having that portion which is located closest to an engagable surface of the other pole piece, as measured in the direction of travel of said plunger within the confines of said coil.

THE REFERENCES OF RECORD RELIED ON ARE:

Fuscaldo	2,297,399	Sept. 29, 1942
Hammond	2,420,241	May 6, 1947
Bosch (Swiss)	93,102	Feb. 16, 1922
Heinrich (German)	662,027	July 4, 1938
Gachon (French)	876,454	Aug. 3, 1942

A description of applicant's device appears in applicant's brief, pages 10-10b.

DESCRIPTION OF THE REFERENCES

Fuscaldo discloses a fuel injection valve which has a solenoid actuator. The valve has an inlet at 19 and a valved outlet at 43. The solenoid actuator includes a coil which is enclosed within housing members 1, 2, 3 and 12. Members 1, 2 and 3 are made of magnetic material and member 12 is made of non-magnetic material. A

plunger stop member 4 of magnetic material is mounted in one end of the housing. The other end of the housing has slidably mounted therein an armature 5. Armature 5 is connected to the valve head 10 to control actuation of the valve. A spring 11 biases the valve head to closed position. When assembled, a magnetic path as illustrated by arrows 6 is established. The only gap in the magnetic path 6 is that gap between the armature 5 and the stop member 4 when the coil is deenergized.

Hammond is relied on as disclosing a valve casing 591 which has slidably mounted therein a valve stem 592, which is held in the position shown in Fig. 1 by means of a spring 593. An inlet port 594 in casing 591 is connected to a supply pipe 595. Exhaust port 596 is provided at one end of the valve casing 591 and an outlet port is at 589. One end of the valve stem 592 is connected by a link 597 to a core 598 of a solenoid 599, the casing 601 of which is made of magnetic material. The core 598 slides in a tube 602 of a non-magnetic material such as brass, in the other end of which is mounted a fixed core 603 of magnetic material. An annular piece 604 of magnetic material connects the casing 601 with the core 603. Wound on the tube 602 is a winding 605, the two ends of which are connected to conductors 606 and 607. The conductor 606 is connected through a key 608 to a battery 609 the other side of which is connected to the conductor 607.

Bosch is relied upon as disclosing in Fig. 3 a coil *h* which has mounted therearound a magnetic material means 1. The magnetic material means 1 has portions which extend into opposite ends of the hole through the coil. The opposite ends define an air gap therebetween. Freely mounted within the coil and the opposite ends of

the magnetic material means 1 is a plunger *i*. It is also noted that the air gap defined by the opposite ends of the magnetic material means 1 is at the center of coil *h*.

Heinrich is relied upon as disclosing a solenoid actuator which comprises a coil 2 with housing parts 1 of magnetic material which extend into opposite ends of the coil and an outer cylindrical housing part of magnetic material which interconnects end parts 1. An L-shaped member is positioned within the bore of the coil and the end parts 1. This L-shaped member is apparently made of non-magnetic material since such a member is usually made of non-magnetic material as evidenced by the other references of record. A plunger 14 is slidably mounted in one of the housing parts 1.

Gachon is relied upon as disclosing a solenoid valve 14 which has a magnetic circuit means 15, a coil 16 and a movable core 17 which terminates at 18 in a needle point constituting a cutoff at the port 7. A spring 19 positioned between the core 17 and the fixed member 20 biases the needle point onto its seat. The member 20 has a fluid inlet 22. *Gachon* does not describe of what material the T-shaped member at the center of coil 16 is made. However, it appears to be obvious that such T-shaped member is made of non-magnetic material since such members are usually made of non-magnetic material, since the magnetic path 15 approaches such member but bends and goes around such member and since such member is illustrated as a separate member from the other structure which surrounds coil 16. Certainly, if a person having ordinary skill in this art were asked to make a solenoid valve as shown by *Gachon*, he would make the T-shaped member of non-magnetic material.

THE REJECTIONS

Claims 1-16 are rejected as unpatentable over Gachon. These claims are directly readable on Gachon if it is assumed that the T-shaped member at the center of coil 16 is made of non-magnetic material. The examiner is of the position that it is obvious that such T-shaped member is made of non-magnetic material since the magnetic path 15 proceeds towards such T-shaped member and then bends to go around and bypass such T-shaped member. If such T-shaped member were made of magnetic material, the majority of the flux from the coil would flow directly through such T-shaped member and not around such member. That is, with the T-shaped member made of magnetic material the most of the lines of flux would be short-circuited away from the movable core 17 by way of the T-shaped member. Such short-circuiting would cause the solenoid to be very inefficient and impractical from the standpoint of current consumption.

If the T-shaped member is made of magnetic material, why is it a separately cut element from the other elements around the coil? It is noted that applicant argues that the coil is probably threaded through an opening which is subsequently closed by the T-shaped member. It is noted that applicant does not describe how the T-shaped member is inserted to close the opening. As illustrated, the T-shaped member is one piece. The examiner is of the position that the device of Gachon is schematic insofar as the assembly is concerned and that a person of ordinary skill could assemble the device in a conventional manner such as suggested, for example, by Hammond or Heinrich.

It is also noted that it was necessary for applicant to experiment in order to find out if the device would operate at all if the T-shaped member were made of magnetic material. It is certainly obvious to any person skilled in this art, in the absence of any experimentation, that if the T-shaped member is made of non-magnetic material, the device will operate efficiently.

Therefore, the examiner is of the position that Gachon discloses indirectly that the T-shaped member is made of non-magnetic material.

Claims 1-8, 10 and 12-16 are further rejected as unpatentable over Hammd in view of any one of Heinrich, Gachon or Bosch. It would be an obvious expedient within the skill of one versed in this art to extend the end of housing part 601 of Hammond, which is in contact with the core 598, into the hole in the coil as taught by any one of Heinrich, Gachon or Bosch. Certainly, any one of these references teaches extending the magnetic material means into the opposite ends of the hole through the coil. It is also noted that the air gap between the core 598 and stop member 603 of Hammond is in the virtual center of the coil 605. It is also pointed out that as shown in Hammond, one end of member 601 has a bore which slidably receives the core 598. Certainly this bore portion of member 601 serves to help guide the core 598. The examiner is not aware of the fact that all magnetic materials are harder than brass. Therefore, it is not perfectly safe for the examiner to assume that all magnetic materials are harder than brass, as contended by applicant.

Claims 1-8, 10 and 12-16 are still further rejected as unpatentable over Fuscaldo in view of Gachon or Bosch.

It would be an obvious expedient within the skill of one versed in this art to extend a portion of end member 2 of Fuscaldo into the hole in the coil 30 and to position the air gap of the device at the center of the coil 30 as suggested by Gachon or Bosch. This modification could be accomplished by extending a portion of end pole member 2 into the hold in the coil and decreasing by an equal amount portions of members 4 and 12 in the hole of the coil. The armature would be repositioned and the valve stem 9 made longer. Bosch and Gachon clearly teach having the air gap at the center of the coil and the moving of the air gap of Fuscaldo to the center of the coil in view of such teaching appears to be an obvious expedient.

Respectfully submitted,

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I Weil I. W.

Paper No. 18

Received May 19, 1961

IN THE UNITED STATES PATENT OFFICE
BEFORE THE BOARD OF APPEALS

Appeal No. 38,512

In re application of VINCENT W. ECKEL Serial
No. 661,837 Filed May 27, 1957 For Solenoid Operated
Actuator and Valve.

Applicant's Reply to Examiner's Answer.

Applicant does not intend, nor is he allowed to, at this time, comment on those matters in issue and thoroughly discussed thus far during the prosecution of this application. This comment is therefore directed to matters needing further clarification in view of the Examiner's description of the references and his rejections thereon.

Firstly, in discussing the Fuscaldo reference on page 3, the Examiner states "The only gap in the magnetic path 6 is that gap between the armature 5 and the stop member 4 when the coil is deenergized." Applicant makes exception to the Examiner's use of the words "The only gap" in this quoted sentence since page 3, lines 45-50, second column, clearly indicates that there is a chromium plating which introduces at least one more air gap.

Secondly, in discussing the Bosch patent the Examiner refers to "the air gap" (underscoring supplied). By using the word "the", the Examiner implies that

there are no other air gaps and this is certainly not true in view of the fact that the armature i is purposely spaced from the magnetic structure so that the armature i may move laterally with respect to the magnetic structure.

Thirdly, the greatest objection which applicant has, is the Examiner's statement in the second paragraph on page 6 of the Examiner's Answer in which the Examiner states ". . . that it was necessary for applicant to experiment in order to find out if the device would operate at all if the T-shaped member were made of magnetic material." This statement is not true. It was readily apparent to applicant that the device shown in the French patent would operate if the T-shaped member were of magnetic material. It is true that a model was made for demonstrating operativeness *solely* for the Examiner's benefit in view of certain statements made during the prosecution of the application in which the Examiner indicated a short-circuited condition. Through the Examiner's use of the term "short-circuited" in his Office Action dated May 25, 1959, applicant interpreted the Examiner's remarks in that respect as meaning that the device in the French patent would be inoperative if the T-shaped member were of magnetic material. A model was built and demonstrated to the Examiner solely for the purpose of showing the Examiner that the device in the French patent would be operative and is indeed operative when the T-shaped member is of mag-

netic material. By doing so, applicant thought the same would convince the Examiner that the arrangement shown in the French Gachon patent would be operative either when the T-shaped member is of magnetic material or is of non-magnetic material and thus the French patent, being a foreign reference, was subject to conjecture and could not be used in the most favorable light. Many decisions were cited supporting applicant's position.

Respectfully submitted,

/s/ LYON & LYON

Attorneys for Applicant

FEMauritz/B

IN THE UNITED STATES PATENT OFFICE
BEFORE THE BOARD OF APPEALS

Appeal No. 38512

In re application of VINCENT W. ECKEL Serial
No. 661,837 Filed May 27, 1957 for Solenoid Operated
Actuator and Valve.

Affidavit of Vincent W. Eckel.

State of California, County of Los Angeles — ss:

Comes now Vincent W. Eckel, who, after being duly
sworn, deposes and states the following:

1. That he resides at Route 1, Box 65G, San Luis
Obispo, California, is the applicant in the above-entitled
patent application and is familiar with the disclosure and
claims therein.

2. That he was the founder and is presently the
President of Eckel Valve Co., a California corporation,
formed to manufacture and sell valves presently dis-
closed and claimed in said patent application.

3. That the primary business of said Eckel Valve
Co. has continuously been from its inception and still is
the manufacture and sale of said valves presently dis-
closed and claimed in said patent application and such
manufacture and sale has over the years and still
continues to average, on a yearly basis, approximately
ninety-nine percent of the gross income of said Eckel
Valve Co.

4. That Eckel Valve Co. has made the following sales of said valves presently disclosed and claimed in said patent application:

In 1951, 1 Customer bought 10,244 Valves, for \$178,191.00

1952, 1	"	"	9,227	"	"	213,317.00
1953, 10	"	"	9,664	"	"	237,102.00
1954, 10	"	"	10,379	"	"	312,834.00
1955, 24	"	"	11,471	"	"	321,939.00
1956, 30	"	"	13,508	"	"	412,289.00
1957, 42	"	"	12,924	"	"	625,536.00
1958, 72	"	"	12,879	"	"	462,435.00
1959, 93	"	"	16,894	"	"	602,293.00
1960, 80	"	"	8,246	"	"	460,024.00
1961, 74	"	"	7,238	"	"	515,539.00

and some of these customers include:

Lycoming-Division

Avco Manufacturing Corp.

Stratford, Connecticut

Aerojet-General Corp.

Sacramento Plant

Douglas Aircraft Co.

Long Beach, California

Grumman Aircraft Engineering Corp.

Bethpage, Long Island, New York

AiResearch Mfg. Co.

A Division of Garrett Corp.

Los Angeles 9, California

Bell Aerosystems

Buffalo, New York

AiResearch Mfg. Co.

Los Angeles, California

General Electric Co.

5. That valves manufactured in accordance with the disclosure and claims in said patent application have found particular usefulness in aircraft installations, space vehicles, missiles and rockets, mainly because of their small size, small weight, small electrical current requirements and reliability, and some of their uses in space vehicles are set forth in the following table which shows the particular Eckel Valve Co. valve and correspondingly the company using such valve, the use of such valve and the name of the space vehicle on which the same has either been used or, in the case of the Gemini vehicle, is intended to be used:

Aerospace Uses

<u>Eckel Valve Co. - Valve No.</u>	<u>Company</u>	<u>Use</u>	<u>Vehicle</u>
AF77	AiResearch	Oxygen breathing valve	GEMINI
AF37	AiResearch	Environmental control system	GEMINI
AF77	AiResearch	Blood Pressure Measuring system	MERCURY
AF56, AF102	Bell Aerosystems	H ₂ O ₂ Attitude Control	MERCURY
AF77	McDonnell	Chimp Couch	MERCURY
AF15, AF108	Bell Aerosystems	H ₂ O ₂ Attitude Control	CENTAUR
AF108, AF15	Convair Astro.	H ₂ O ₂ Attitude Control	CENTAUR
AF42	General Elec. MSVD	Bio-physics System	DISCOVERER (Nose Cone)
AF42	Grumman Aircraft	Pressurization System	ECHO II
PT70C-1, PF77	Beckman Instruments	Helium Subsystem for The Gas Chromato- graph	SURVEYOR
AF35, BF62, BF62	Fairchild Camera	Camera lens defogging & deicing system	CLASSIFIED SPACE VEH.
AF59, BF56, AF102, AF59, AF77	Wright Aero Div.	Hydrozine, UDMH, N ₂ Spacecraft Attitude Control Systems	CLASSIFIED
AF35, AF77	Nortronics	Heat Exchanger	SKYBOLT

<u>Eckel Valve Co. - Valve No.</u>	<u>Company</u>	<u>Use</u>	<u>Vehicle</u>
BF14	Aerojet- Sacramento	RP-1 Valve on Engine	TITAN I
AF63, AF62	Robertshaw- Fulton	Fueling System Helium Regulator	TITAN II
BF14, AF14,	Aerojet- Sacramento	Aerozine Pilot Valves	TITAN II
AF56	AiResearch Mfg. Co.	APU Hydraulic unloading valve	NIKE - Hercules
AF56	AiResearch Mfg. Co.	Fuel Valve	NIKE- Hercules
AF37, AG102, AF103	General Elect. Malta	G.S.E.	PROJECT 698
AF56	Lockeed, Sunnyvale	Hi Pressure Nitrogen System	AGENA II
AG102, AG102, AG102	Radioplane- Van Nuys	Nitrogen Valves Recovery System	PIGGYBACK AEC OPERATION
AF77	North American Columbus	Air Bleed	ROAD- RUNNER, REDHEAD

6. Exhibits A and B hereto are drawings showing constructional features of the Eckel Valve Co. valves AF56 and AF102 installed on the Mercury Capsules listed above and used in space orbital flights, and Exhibit C attached hereto is a photograph showing the manner in which such valves were mounted on the inside skin surface of such Mercury Capsules.

7. Exhibit D attached hereto is a brochure of Eckel Valve Co., Form 4-202, and on the first inside page shows valves made in accordance with the disclosure and claims in said application, the valves AF77C and AF70C-1 being shown in full size. The AF77C valve weighs one and three-quarters (1-3/4) ounces and replaced a conventional valve weighing nine (9) ounces

previously used in a cabin pressure regulator in commercial and military aircraft. Over forty thousand such AF77C valves have been manufactured and sold by Eckel Valve Co. for use in such cabin pressure regulators. The AF 70C-1 valve is the smallest solenoid valve in the world to the best of his knowledge and weighs a fraction of one ounce and is used in connection with a gas chromatograph on the Surveyor vehicle for exploration of atmosphere on the moon.

Further Affiant Sayeth Not.

/s/ VINCENT W. ECKEL

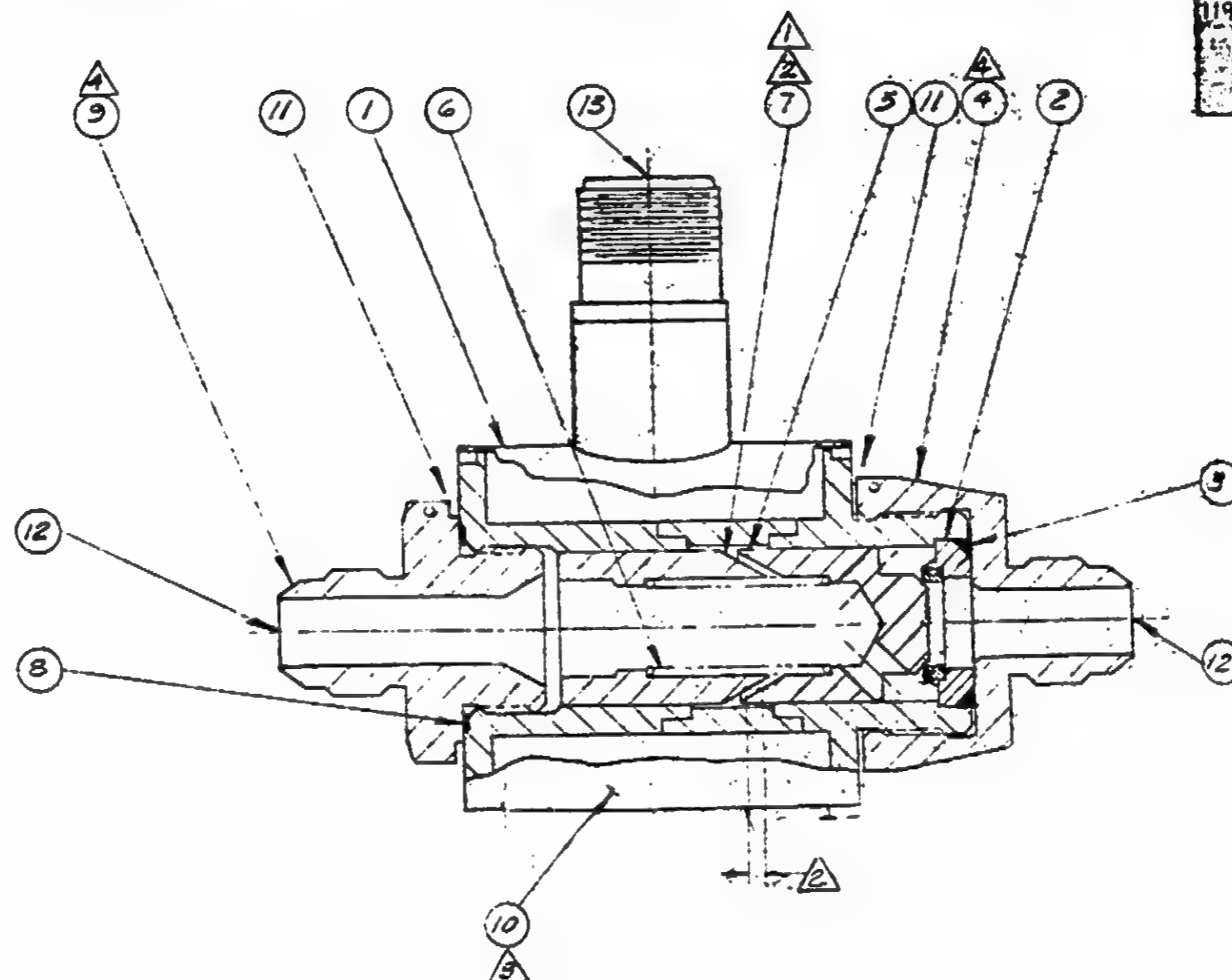
Vincent W. Eckel

SUBSCRIBED AND SWORN TO before me
this 10th day of October, 1962.

Dorothy P. Brennan
Notary Public in and for said
County and State

DOROTHY P. BRENNAN
My Commission Expires June 18, 1966
(SEAL)

AF102-3501	COIL ASSEMBLY	1	
AF102-1104	SEAT ASSEMBLY	1	(B)
AF102-2505	OUTLET SEAL	1	
AF102-1506	OUTLET	1	
AF102-1103	PLUNGER	1	(B)
AF102-1102	SPRING	1	
AF102-1101	STOP	1	
AF102-2504	INLET SEAL	1	
AF102-2713	INLET	1	
AF102-1106	NAMEPLATE		
MS3025F32	LOCK WIRE	F/R	
EC-6	SHIPPER CAP	2	
EC-10	CAPLUG	1	



1196	B	REVISED PICTURE TO COMPLY WITH AF102-1104	AF102-1103	AF102-1104
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EXHIBIT - B

AF102M-11

(B)

WIRELOCK PER MS33540

INSTALL WITH ARROW POINTING IN DIRECTION OF FLOW.

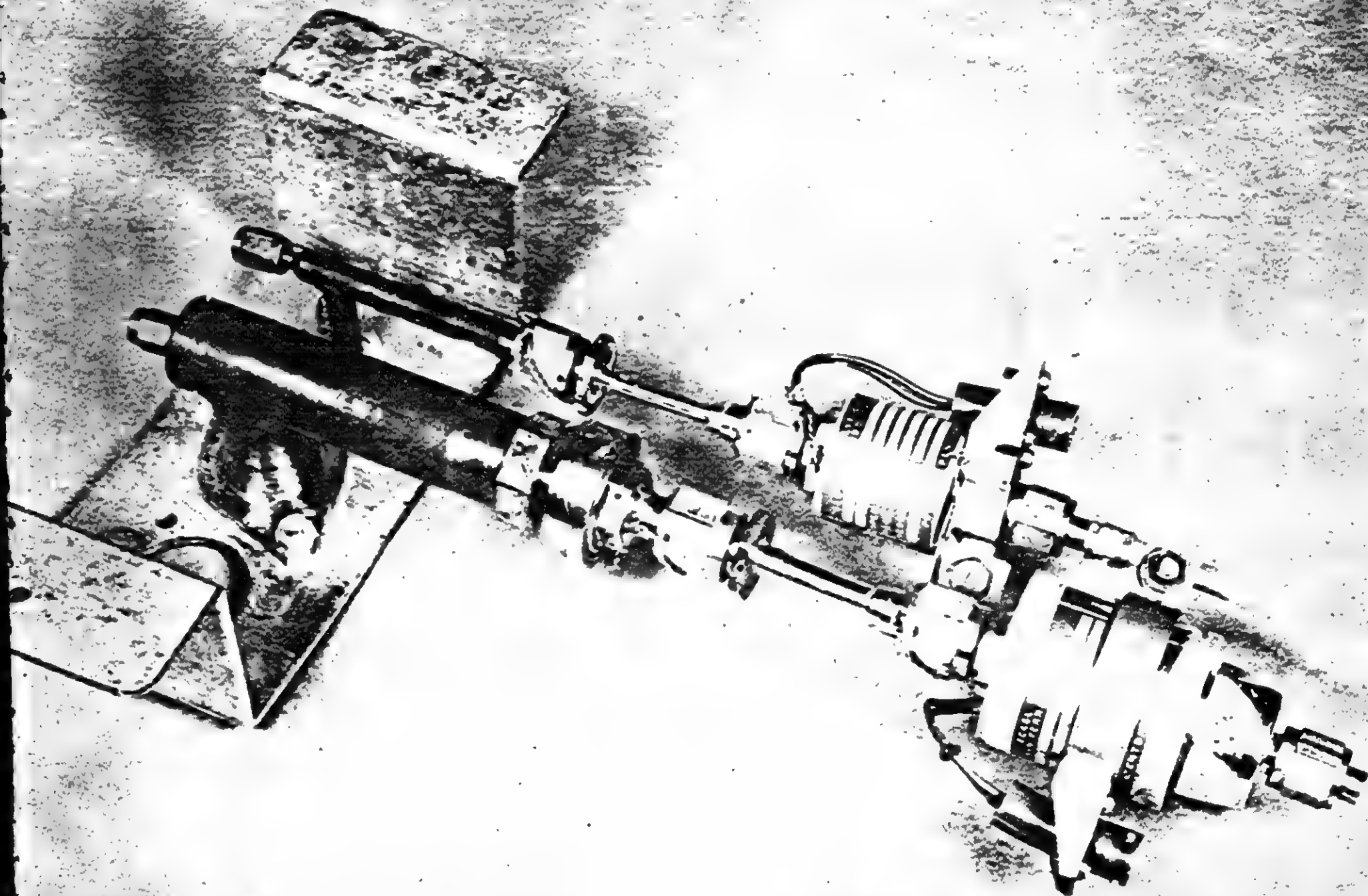
ADJUST ITEM 7 TO OBTAIN O.D. STROKE.

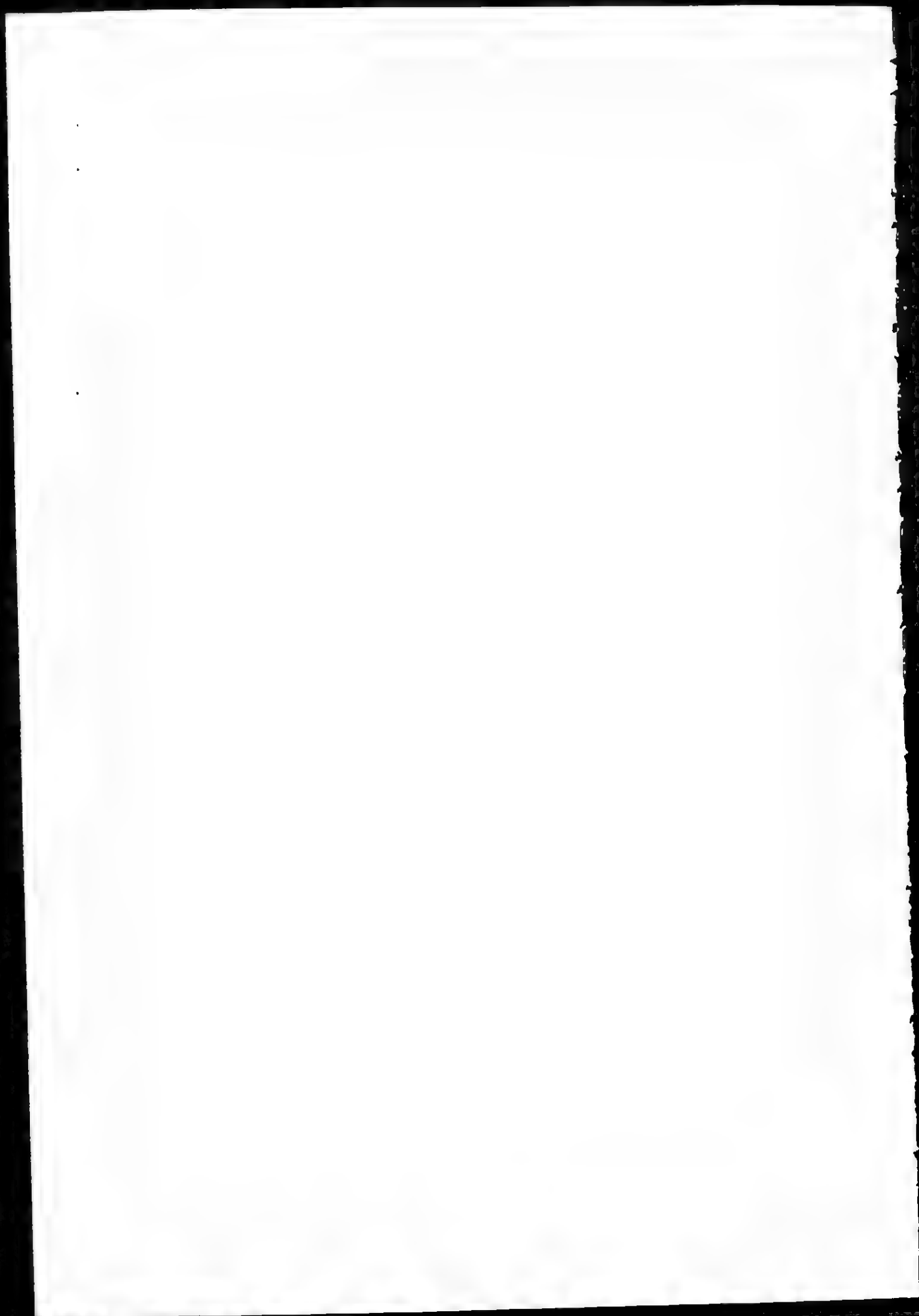
LUBRICATE O.D. WITH LEO-PLATE #250 OR EQUIV. BEFORE INSTALLING.

NOTE:

UNLESS OTHERWISE NOTED: 1. TOLERANCES FRACTIONAL 1/64 INCH ± .005 DECIMAL .015 ± .001 (Apply only to regular features) (Unless noted use AMERICAN) 2. CONCENTRICITY C = T.A.R. 3. DIMENSIONS shown to be met before painting 4. SEALS all sharp edges .005 approximately 5. BORE all bore 6. ALL MACHINING SURFACES ✓ OR BETTER		MATERIAL SPECIFICATION TITLE MANUFACTURING ASSEMBLY	HEAT TREAT FINISH DATE 2X USED AF102M-11	DRAWN BY POMB CHECKED BY RUSH APPROVED BY DHP DATE 11/1/59 NAME ECKEL VALVE CO. SAN BERNARDINO CALIFORNIA
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EXHIBIT C





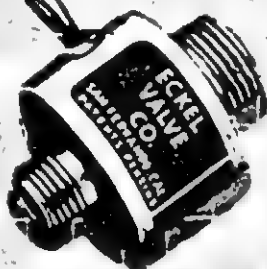
Coaxial, Solenoid Operated Shut-off Valves offering extreme compactness and reliability through a new concept in valve design.

EXHIBIT D



"the **LITTLE** valve that does

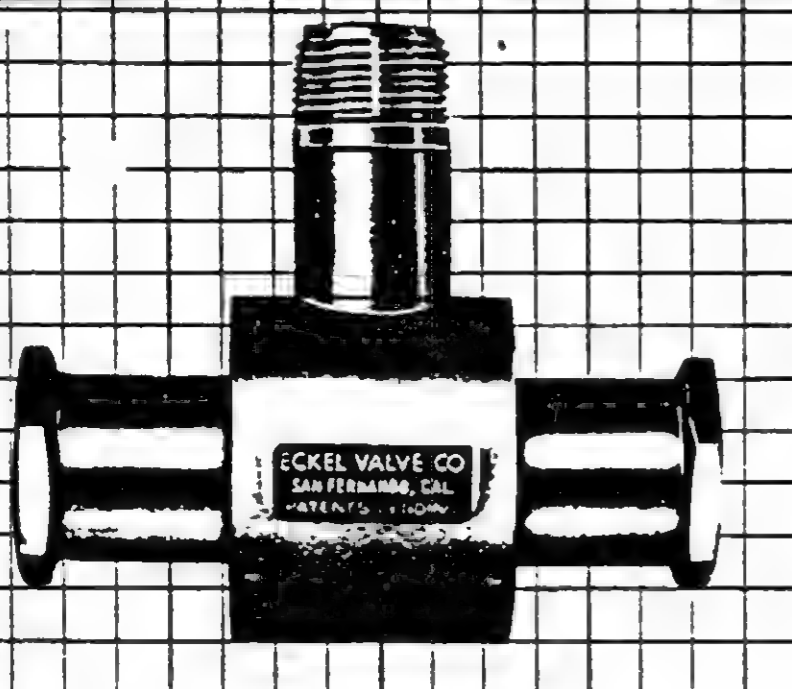
a **BIG** job"



eckel VALVES

eckel VALVE CO., 1425 FIRST ST., SAN FERNANDO, CALIF.

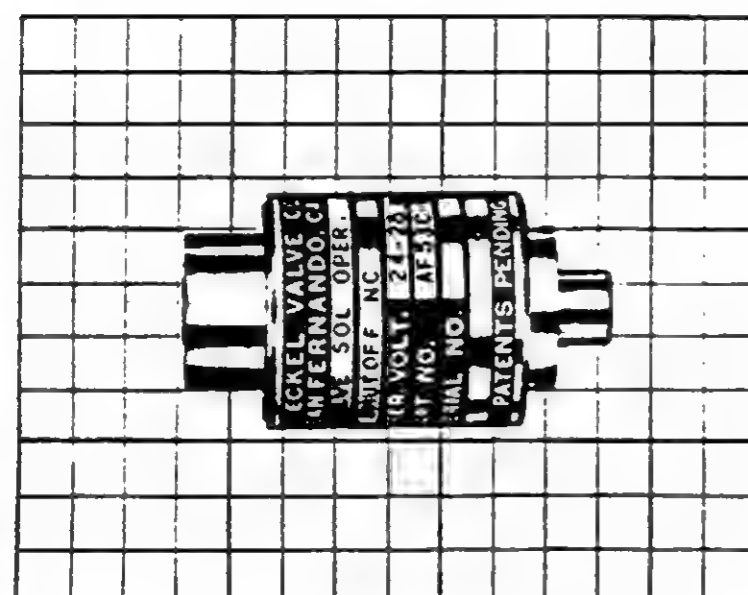
ORIGINATORS OF COAXIAL SOLENOID VALVES FOR AIRCRAFT



AF14C SERIES SHUT-OFF VALVES

These coaxial type valves are available as normally open or closed and can accommodate pressures from 0 to 3000 psi with equivalent orifice diameters ranging from .300 down to .025, respectively, operating at 18 to 30 V. DC. An unbalanced poppet construction is employed in conjunction with a teflon seat. Can be used with air, oil, fuel, alcohol, etc. Qualified. Weight - 12.5 oz.

"straight thru" type flow passages for minimum pressure drop—

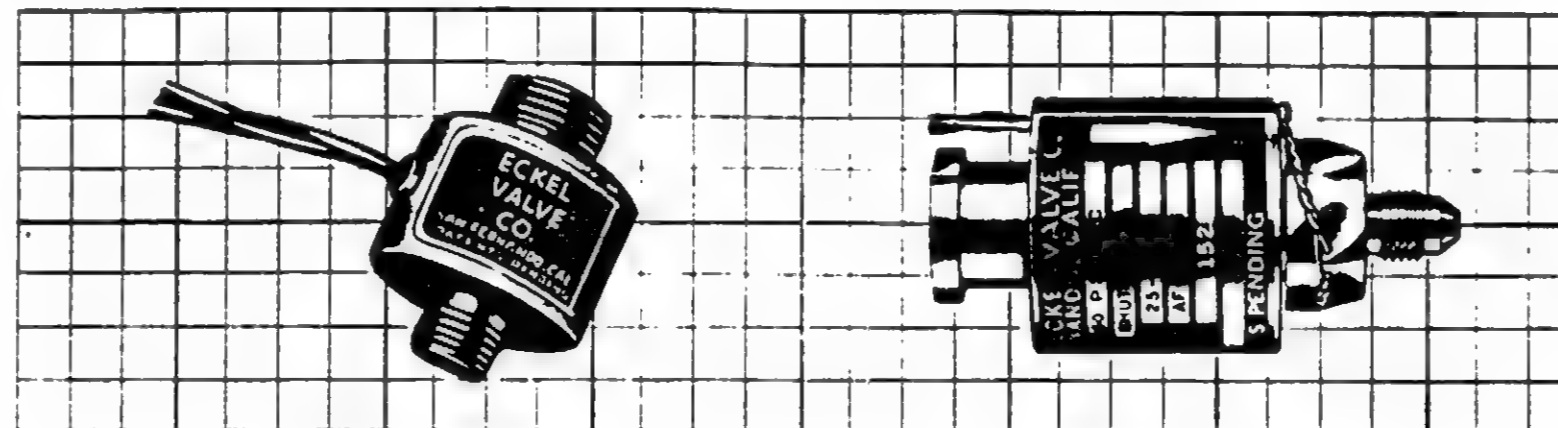


AF53C-9 NORMALLY CLOSED, RFNA COUPLING VALVE

Designed for missile fueling coupling, this coaxial valve is "buried" in the coupling casting with an o-ring seal at each port end. Submersible coil construction in event of splash or flooding. 15 psi .023 equivalent orifice. 5.5 ounce weight.

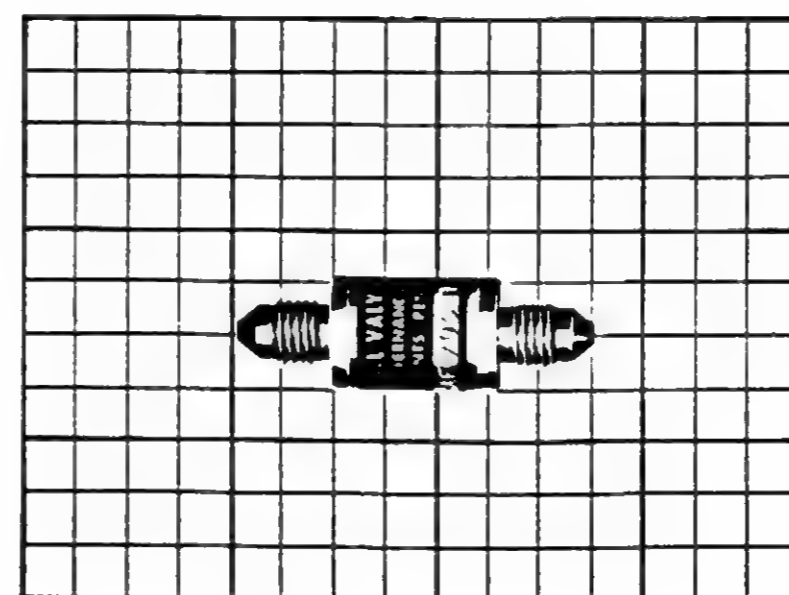
AF77C SERIES COAXIAL SHUT-OFF VALVES

These valves are available as normally open or normally closed units, and will operate at 70 psi at 17 V. DC. Equivalent orifice diameter is .050. A teflon seat provides zero internal leakage and the ability to handle practically any fluid medium. Variety of port configurations available. Qualified. Weight - 1 1/4 oz.



AF70C-1 NORMALLY CLOSED, 1/8" T.S. MIDGET

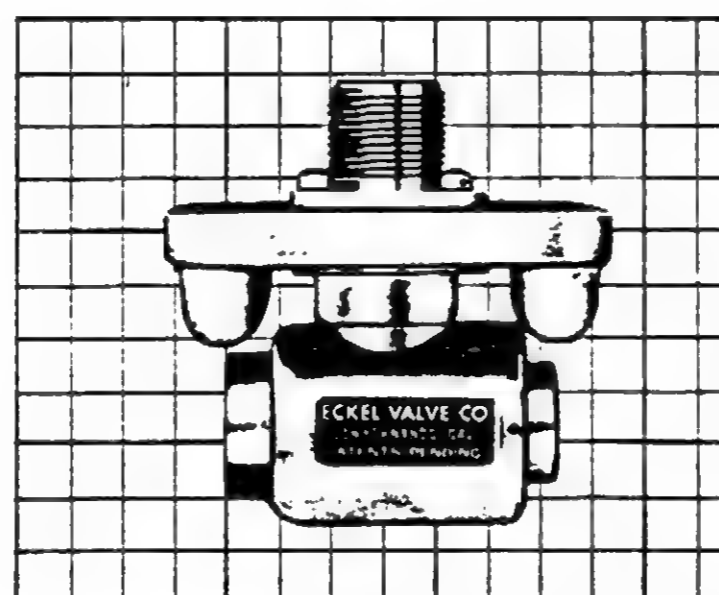
The smallest known solenoid valve developed for instrumentation where space is at a premium. Up to 60 psi with .025 equivalent orifice depending upon duty and temperatures. Less than one ounce weight.



typical eckel coaxial solenoid valves and applications

AF56C NORMALLY CLOSED 1000 PSI FUEL CONTROL

Flow modulation or metering obtained from 28 V. DC electrical, pulsed signals of frequency and duration to effect a proportioning control system. The Eckel coaxial design not only saves space and weight but also makes possible fast response time due to the lack of moving seals which minimizes internal friction. 1,000 PSI with .047 equivalent port dia. which can be modified for 3,000 PSI systems for almost any fluid. No rubber or rubber-like compounds in contact with the fluid due to the Eckel integral construction. Teflon seat with positive metal-to-metal stop provides minimum internal leakage and maximum reliability.



AF35C SERIES, NORMALLY OPEN OR CLOSED, 60 PSI FUEL SHUT-OFF VALVE, 23 — 30 V. DC

Valves in this series are unique in that the entire coil is completely sealed and is designed to operate submerged in fuel. These units employ a molded buna-N seat which affords zero leakage. Equivalent orifice diameter .120. Weight - 9 oz.

GENERAL

The Eckel Valve Company is a young and aggressive organization established in 1950 by Vincent W. Eckel, inventor of the coaxial solenoid valve principle described in this brochure. This fundamental idea has been enlarged upon and its basic advantages have found widespread application in the aircraft industry.

Our products were all custom designed for specific problems, but because of the large number of types and variations in production, it is often possible to make very quick delivery. Eight classes of valves are discussed in this bulletin, and the modifications of ports, seats, coils, and materials run into thousands. Still, if your particular problem demands a completely new approach, we will design and build whatever is needed, in any quantity.

FEATURES

• OPERATING PRINCIPLE*

By employing a unique arrangement of the magnetic circuit, in which the functions of the solenoid plunger and the valve poppet are combined, the number of moving parts is reduced to one. This results in extreme simplicity and provides an inherently clean flow path through the center of the solenoid. We feel that this principle enables us to meet most valve requirements with a unit of minimum size and weight.

• ZERO INTERNAL LEAKAGE

The poppet and seat construction on the majority of Eckel coaxial valves can easily provide zero leakage where required, even for air or gases.

• ZERO EXTERNAL LEAKAGE

There are no static seals nor gaskets in these valves, the pressure being confined by solid metal construction, hydrostatically tested.

• NO RUBBER PARTS OR SEALS USED

Practically all valves employ teflon seats which enables them to handle practically any fluid. (Rubber seats available upon request.)

• RAPID ACTUATION TIME

Since all coaxial valves are directly operated, times of operation will range from 5 to 20 milliseconds depending on the application.

• ACCURATE RESTRICTION

Upon request, these valves can be furnished as restrictors, with the flow vs pressure drop relationship fixed very precisely. Such arrangements are tamper-proof in the field, and provide space savings.

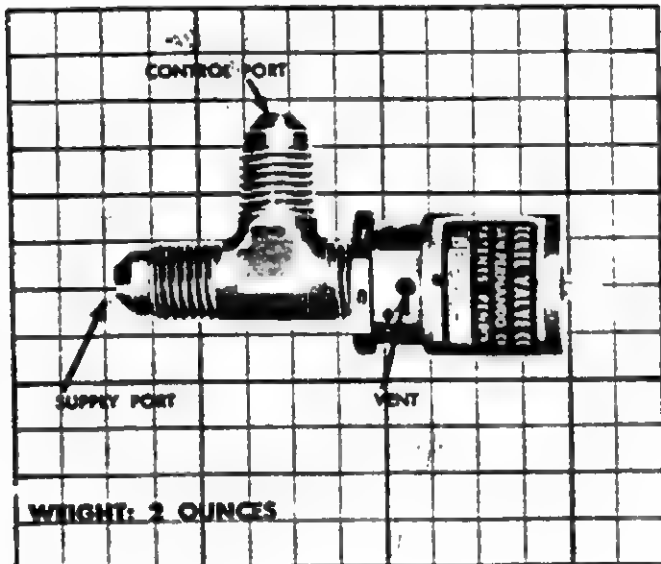
• EXOTIC ROCKET FLUIDS

The compact, simplified Eckel coaxial design is now in use for UDMH, Hydrogen Peroxide, RFNA, Anhydrous Hydrazine, and other hard to handle fluids.

* PATENTS PENDING

outstanding **NEW** designs

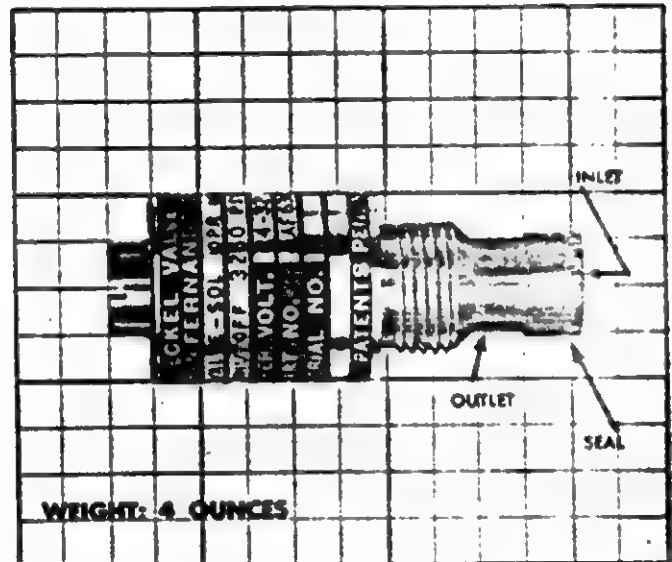
from eckel valve company



BF 62C-1

THE 2 OUNCE - 3 WAY

Greater miniaturization than our prior 3 ounce 3-way. Designed for small cylinders, bleed, instrumentation, etc. 235 psi operation with .035 equivalent orifice at -65° to $+165^{\circ}$ F temperatures. Proven internal construction provides essentially zero leakage for air. Can be used for most liquids when vent can be overboard. Coil can be made submersible and configuration can include a piped vent and/or electrical connector. This basic design is also available in a range of sizes through 2" diameter solenoid with AND10056-8 ports.



AF 63C-2

CRYOGENIC VALVE WITH PLUG-IN FEATURE

One of a series of cryogenic pilot valves for a helium regulator. -260° F to $+290^{\circ}$ F effluent with internal leakage at 3250 psi well below 50 standard cc per minute of helium. Standard coaxial configuration is also readily adaptable to extreme low temperatures but this unit illustrates a series of valves which plug in to AND-10050 ports. Present sizes range from 1/4 inch diameter solenoid for —6 port to 2 1/2 inch diameter solenoid for —8 port depending upon pressures, flows, temperatures, and duty cycle.

*we invite your special
application problems...*



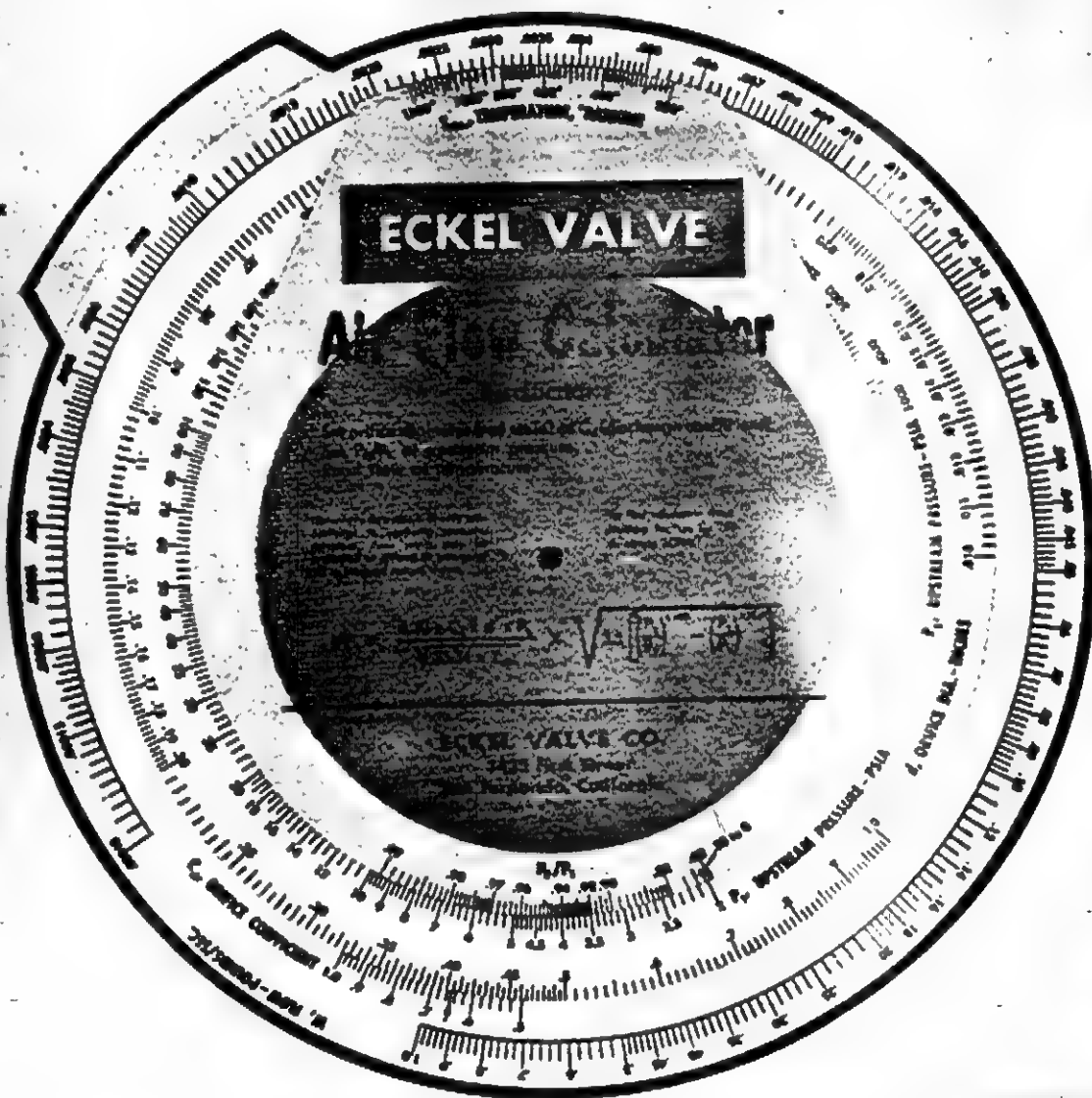
142 Cont.

Now Available

The *eckel* Fluid Flow Calculator

Provides Rapid Calculations of Flow, Pressure Drop,
Orifice Sizing, etc., for Air and Liquids.

LIQUID CALCULATOR
ON REVERSE SIDE



A long wearing precision instrument with scales imbedded in solid vinyl plastic—not paper-board. The calculator is 6 inch diameter providing approximate 15 inch linear slide-rule accuracy. The reverse face provides similar functions for any liquid. With a minimum of easy motions, computations are made without the use of time consuming equations or nomograph charts. Designed, copywrited, and made available as a service item by Eckel Valve Co.

List Price ~~\$6.00~~ \$5.00

Postpaid when remittance
accompanies order.

No C.O.D. Add 4% tax in Calif.

eckel valve co. originators of the coaxial valve for aircraft and missiles

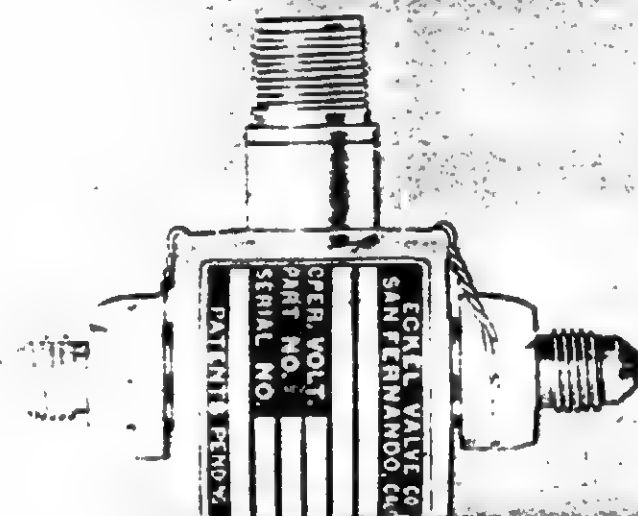
1425 FIRST STREET, SAN FERNANDO, CALIFORNIA



AG102 C-5



AG103C-11



AG59C-1

actual size photographs

NEW an outstanding design concept...

- *piloted — poppet for high pressure operation*
- *coaxial configuration for high flow:*
- *no pressure drop required to operate or remain open.*

AG102 C-5 NORMALLY CLOSED 650 PSI AIR SHUT-OFF — 3/8" T.S.

This unit was developed for a missile application and utilizes a pilot pressure operated principle. Equivalent orifice diameter is .194 and the operating voltage is 27 V.D.C. Thru proper selection of internal seats, this valve can handle practically any common aircraft fluid, and can be easily modified to operate as a 3000 psi hydraulic shut-off. Weight, 1 lb.

AG103C-11 NORMALLY CLOSED 3000 PSI HYDRAULIC VALVE ALLOWING REVERSE FLOW

This valve serves as a shut-off to handle 3 1/2 GPM at 30 psi pressure drop in one direction and will allow a reverse flow in the opposite direction of 2 GPM at 30 psi pressure drop. A precision poppet operating against a hardened seat maintains leakage rates well below 3 drops/min. Weight, 1.3 lbs.

AG59C-1 NORMALLY CLOSED 3000 PSI HYDRAULIC SHUT-OFF — 1/4" T.S.

Another in the series of high pressure pilot operated coaxial shut-off valves, this unit will flow 1.2 GPM hydraulic oil with less than 10 psi pressure drop and offers extreme compactness and light weight. Operating voltage 18-30 V.D.C. Weight, 12 oz.

eckel

SOLENOID SHUT-OFF VALVES

ELECTRO-MAGNETS

SOLENOID THREE-WAY VALVES

SOLENOID ACTUATORS

SPECIAL MANUAL VALVES

eckel

VALVE CO.

1425 Elm Street

San Fernando, California

Paper No. 21

Mailed November 7, 1962

IN THE UNITED STATES PATENT OFFICE

Opinion of the Board of Appeals.

Ex parte Vincent W. Eckel

Appeal No. 385-12

Hearing: October 29, 1962

Application for Patent filed May 27, 1957, Serial No. 661,837. Solenoid Operated Actuator and Valve.

Lyon & Lyon for appellant.

Before Bailey and Freehof, Examiners-in-Chief, and Angel, Acting Examiner-in-Chief.

This is an appeal from the final rejection of claims 1 to 16, all the claims in the application.

Claim 1 is exemplary:

1. An electromagnetic operator comprising a coil, an open ended magnetizable structure magnetically associated with said coil and having spaced pole pieces thereof each within and defining an air gap centrally located within the confines of the coil, said pole pieces extending into opposite ends of said coil, and a plunger slidably mounted on said structure without substantially any air gap between the same, one of the said pole pieces serving as a stop for said plunger when energized said plunger bridging said air gap when said coil is energized, said plunger having a substantial portion thereof disposed within the space defined by said air gap when said coil is deenergized.

The references relied upon are:

Fuscaldo	2,297,399	Sep. 29, 1942
Hammond	2,420,241	May 6, 1947
Bosch (Swiss)	93,102	Feb. 16, 1922
Heinrich (German)	662,027	July 4, 1938
Gachon (French)	876,454	Aug. 3, 1942

The invention is described on pages 10, 10a and 10b of the brief. The references are described on pages 3, 4 and 5 of the Examiner's Answer.

The claims stand rejected as unpatentable over Gachon. Claims 1 to 8, 10 and 12 to 16 were also rejected on Hammond in view of Heinrich, Gachon or Bosch and on Fuscaldo in view of Gachon or Bosch. It is the Examiner's position that the claims read directly on Gachon. Since the magnetic path is illustrated as circumventing the undescribed T-shaped member, he argues it is made of non-magnetic material. He also contends that in view of the sleeve of the coil housing extending inwardly as shown by Heinrich, Gachon or Bosch it would be obvious to continue the Hammond housing inwardly of the coil. Further that with Gachon or Bosch showing an air gap at the center of the coil it would be obvious to move Fuscaldo's air gap to the center of his coil.

Appellant argues that Gachon pertains to a gas pressure regulator so that for Gachon's purpose any electromagnetically operated on-off valve could be used; that the structure and functioning of the disclosed valve is conjectural. He questions how the coil is placed in the body. He contends that the magnetic valve and the T-shaped member are shown by the same type of hatching; that the valve being magnetic, it means that the T-shaped member is also magnetic. He alleges that, since

his model of the Gachon patent with the T-shaped member made of magnetic material was operable, the patented device would be operative with either magnetic or non-magnetic material and that the foreign reference is subject to conjecture precluding its use in anticipation of appellant's claimed subject matter. He notes that Hammond's plunger slides in a non-magnetic guide, his being a pole piece; that Fuscaldo does not have a central air gap located centrally within the energizing coil; that in Heinrich all portions of the plunger lie outside of the effective air gap when deenergized; and that Bosch has a freely floating plunger in a substantial air gap.

The rejections on Hammond or Fuscaldo with Heinrich, Gachon and Bosch are accumulative at best. We will, therefore, express our view point relative to Gachon primarily and with Fuscaldo. We have carefully considered appellant's brief and his arguments at the hearing. We find no reversible error in the Examiner's decision.

Appellant's claims relate to an operator or a solenoid valve; there is no conflict of use or purpose with Gachon's value. The schematic showing of Gachon's value and solenoid housing is anticipatory of appellant's claims because they do not define his elements to distinguish from the prior art disclosure. Also to merely construct the housing in a practical sectional manner for assembly would involve only the knowledge of anyone skilled in this art, especially since Fuscaldo (2,297,399) clearly shows a sectional organization.

Gachon's valve and T-shaped member are definitely illustrated as being different pieces by having different angular hatching. The patent is silent as to the material constituting the T-shaped member. To anyone of aver-

age engineering knowledge in this field it should be beyond doubt that a non-magnetic member is obvious to produce a desired efficiency and to direct the lines of magnetic force as Gachon, himself, indicates. Even though, as appellant learned by experiment, the device will operate with the T-shaped member made of magnetic material, the converse is such a basic factor in securing maximum force at the pole pieces that further explanation would be merely duplication of this view point. Besides, Fuscaldo clearly shows his tube 12 in a position similar to that of Gachon and states that it is non-magnetic.

The pole pieces extending into the coil, one forming a stop for the valve, the other forming a guide for the valve, the air gap being at the center of the coil, the plunger having a substantial portion lying within the limits of the non-magnetic material, and the plunger having close sliding engagement with the end element are clearly shown by Gachon.

The decision of the Examiner is affirmed.

Affirmed

/s/ M. F. Bailey
Examiner-in-Chief
/s/ H. B. Freehof
Examiner-in-Chief
/s/ C. D. Angel
Examiner-in-Chief
(Acting)
Board of Appeals

Lyon & Lyon
811 W. 7th Street
Los Angeles 17, Calif.

Paper No. 23

Mailed December 17, 1962

IN THE UNITED STATES PATENT OFFICE
BEFORE THE BOARD OF APPEALS

Appeal No. 385-12

Ex parte Vincent W. Eckel

Application for Patent filed May 27, 1957. Serial No.
661,837. Solenoid Operated Acuator and Valve.

Lyon & Lyon for appellant.

Before Bailey and Freehof Examiners-in-Chief.

Angel, Acting Examiner-in-Chief.

On Petition for Reconsideration.

This is a petition for rehearing and reconsideration of our decision of November 7, 1962, wherein we affirmed the Examiner's rejection of the claims in this application.

By reason of the number of cases confronting this Board, rehearings are granted only in exceptional situations. We do not find any exceptional circumstances in this case such as would justify a rehearing. The request for reconsideration will be confined to the record already before us.

Appellant alleges that this Board relied on "average engineering knowledge in this field" in interpreting the Gachon disclosure. The complete and thus correct quotation is:

"To anyone of average engineering knowledge in this field it should be beyond doubt that a non-magnetic member is obvious to produce a desired efficiency and to direct the lines of magnetic force as Gachon, himself, indicates."

That is to say: the Gachon disclosure is such that to make the T-shaped member of non-magnetic material would be obvious to a person having ordinary skill in the art, the person being anyone of average engineering knowledge.

In noting that Gachon is silent as to the material constituting the T-shaped member and also that appellant had by experiment learned that the device will operate with the member made of magnetic material, we definitely did not, as alleged in the petition, reach a conclusion that, unequivocally, the member is made of non-magnetic material. We recognized that a magnetic shunt could, and desirably would, be used where needed. Here, finding no reason for so doing, we would expect a person having ordinary skill in the art to use the more efficient gap, one of non-magnetic material.

The prior art to which appellant in the petition directs our attention appears to exemplify our interpretation and explanation. Moard (1,333,626) says he desirably makes his gasket 6 of non-magnetizable material to prevent a flux path being established therethrough. Herion (2,853,659) illustrates by flux lines and explains that the recess 6 in the guidance tube 3 makes "the magnetic lines of force stray outwardly" to the core. Gachon clearly shows the lines of force diverted away from the T-shaped member to the core.

Appellant further alleges in the petition that "the Board's decision is predicated substantially entirely on the disclosure in the French patent 876,454 to Gachon.

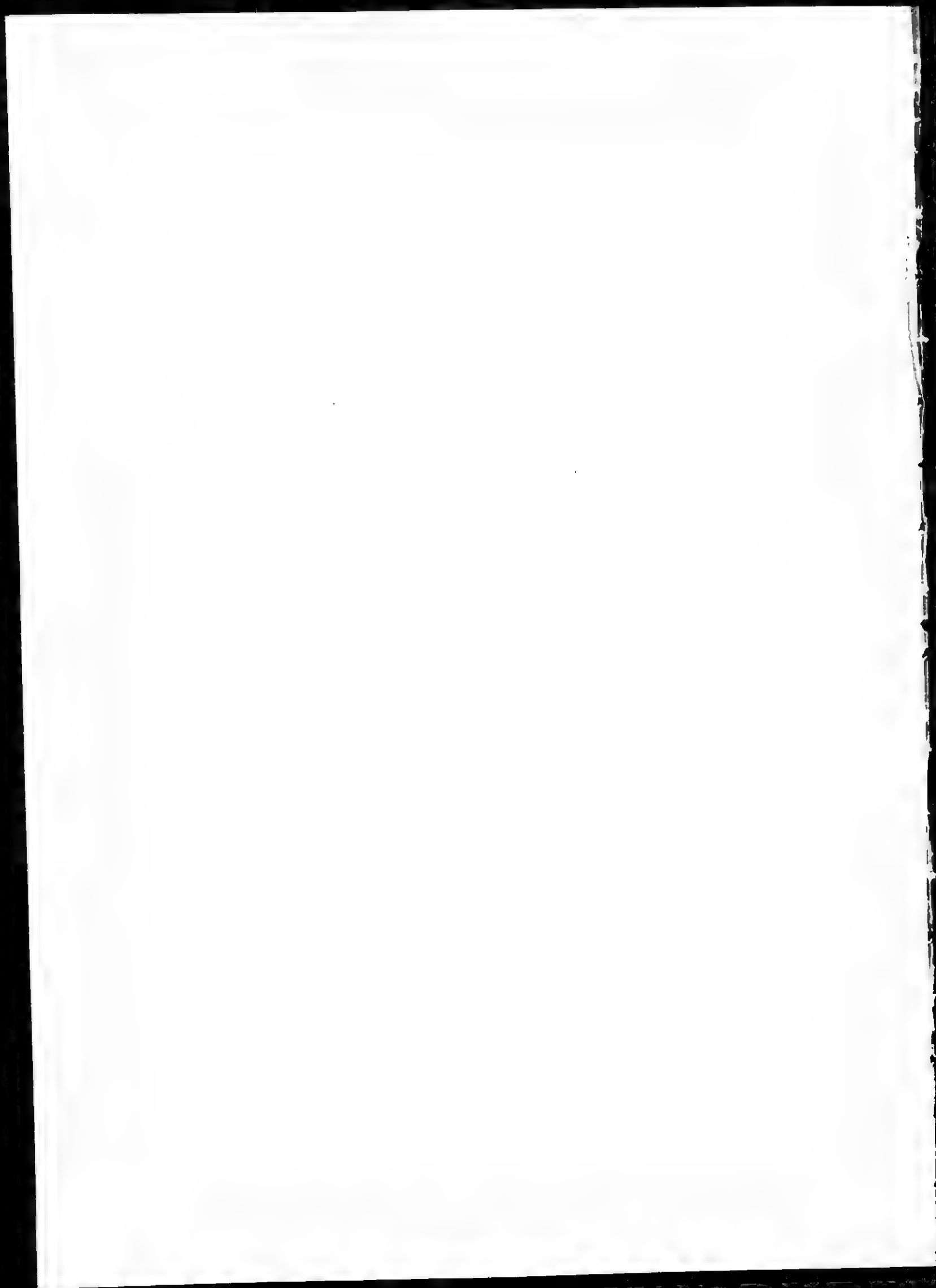
Reference was made to the Fuscaldo patent, applied by the Examiner, which has a diverted flux path illustrated and these words of explanation:

“The tube 12 is made of non-magnetic material such as bronze and, therefore, receives no magnetic flux, which entirely passes through gap 7.”

The petition has been considered to the extent indicated above but is denied with respect to making any change in our decision.

/s/ M. F. Bailey
Examiner-in-Chief
/s/ H. B. Freehof
Examiner-in-Chief
/s/ C. D. Angel
Examiner-in-Chief
(Acting)
Board of Appeals

Lyon & Lyon
811 W. 7th Street
Los Angeles 17, Calif.



PLAINTIFF'S
EXHIBIT
1A

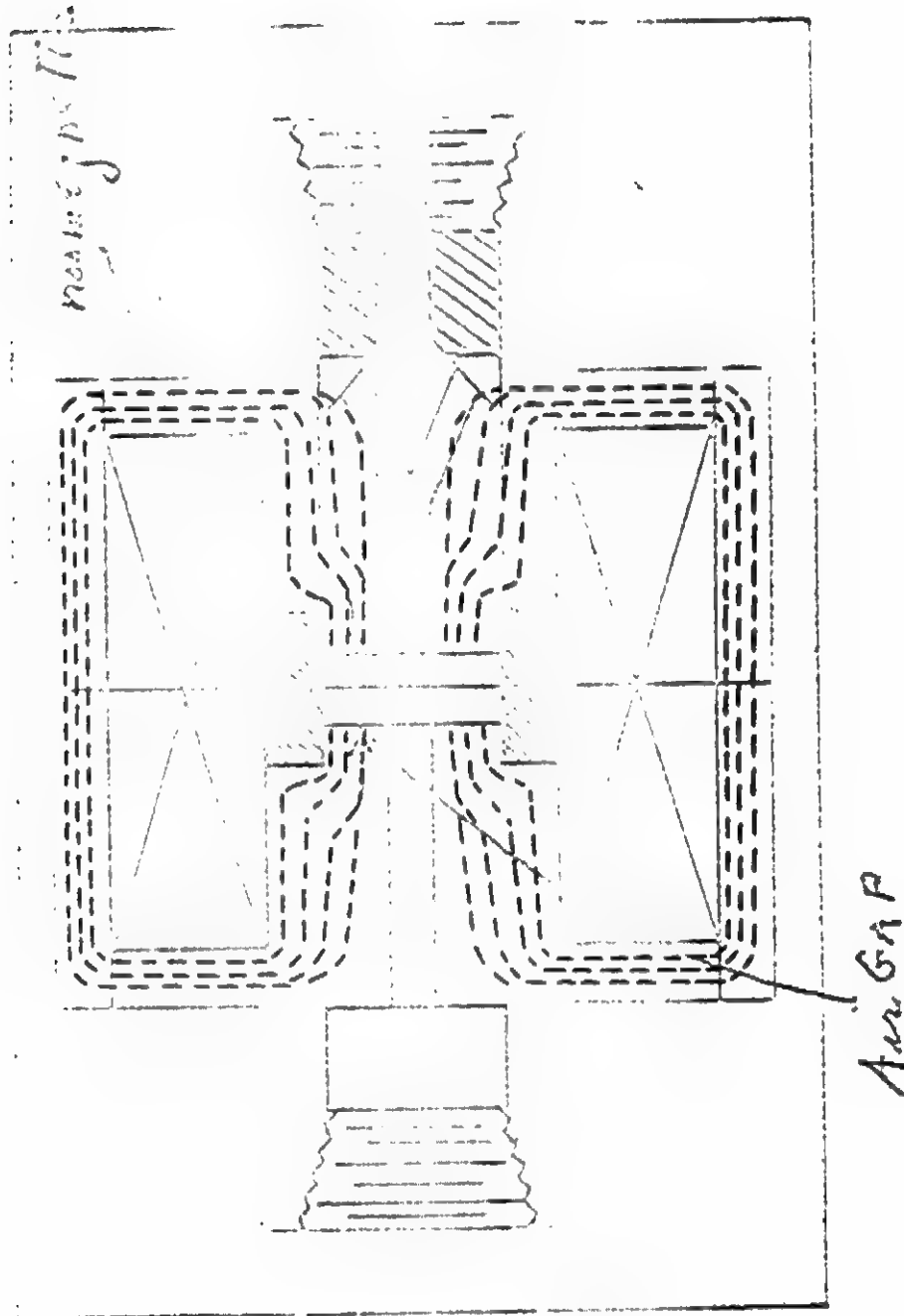


Fig. 1.

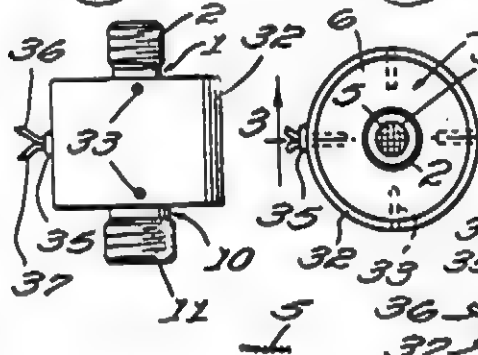


Fig. 2.

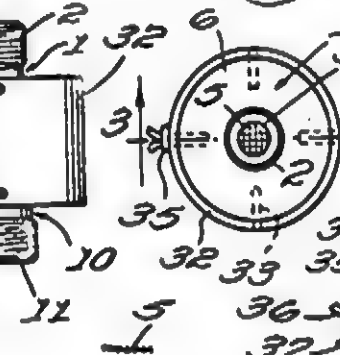


Fig. 3.

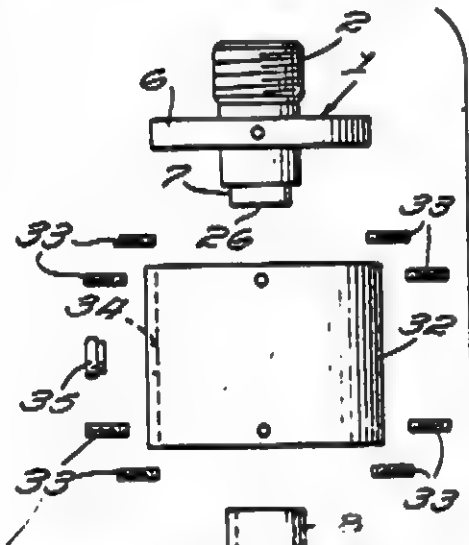
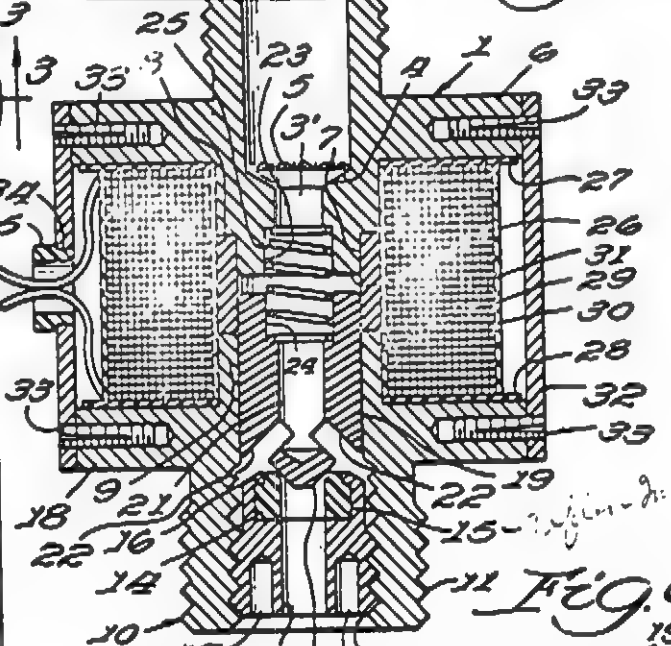


Fig. 5.



Fig. 6.

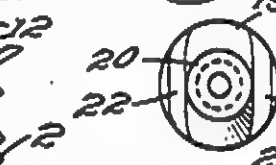


Fig. 7.

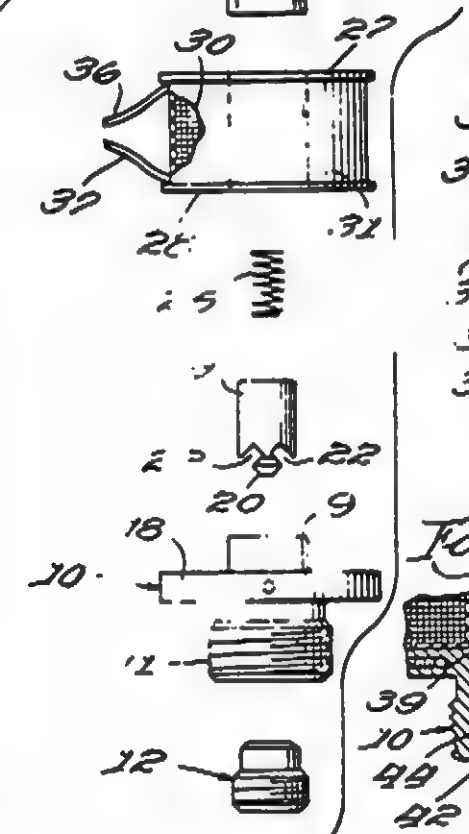
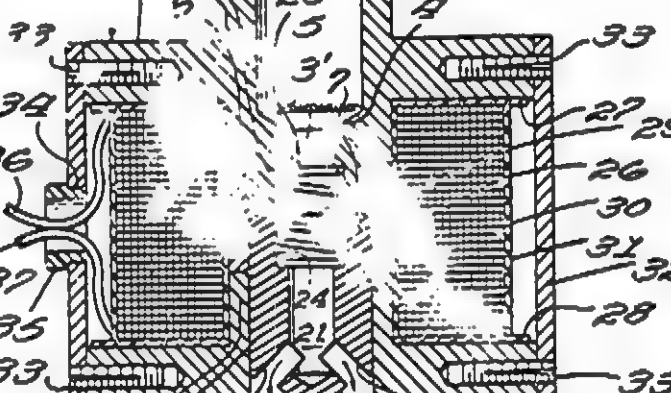
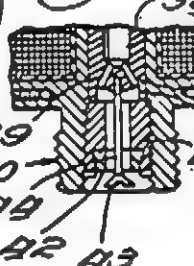


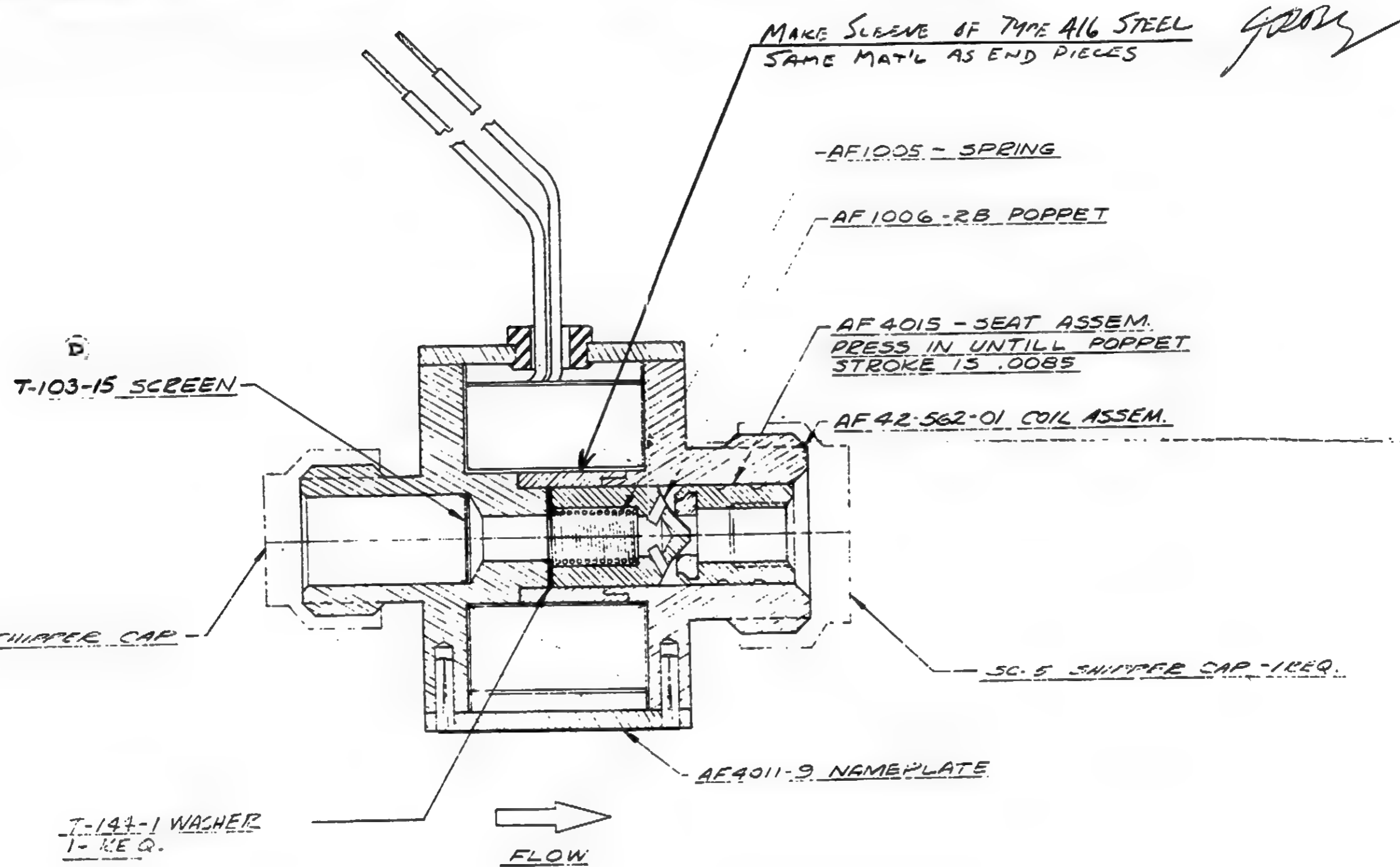
Fig. 9.



sleeve 8
 coil 30
 inlet member 1
 outlet member 10
 sleeve 32
 pole pieces 7
 piston 19
 pole piece 9
 spring 25
 valve 16

INVENTOR.
VINCENT W. ECKEL

BY *W. H. Lyon*
ATTORNEYS



AF42M-562
D

QTY	PART NO	DESCRIPTION
1	T-144-1	WASHER - DROP OUT
1	SC-3	SHIPPER CAP
1	SC-5	SHIPPER CAP
1	T-103-15	SCREEN.
1	AF4015	SEAT ASSEM.
1	AF4011-9	NAMEPLATE
1	AF1006-RB	POPPET
1	AF1005	SPRING
239	AF42-562-01	COIL ASSEM.

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TOLERANCES UNLESS NOTED
Decimal $\pm .005$ Frac $\pm 1/64$
Angular $\pm 1/2^\circ$
Drilled holes per AMS10387
CONCENTRICITY
T.I.R. $\pm .010$
Dims to be met before plating
Remove all burrs
Break all sharp corners .005 R
All machine surfaces 125 unless noted

DRAFTSMAN ECK 3-12-55	CHECKER WPA 4-14-55	APPROVED VRS 4-14-55	MATERIAL
WEIGHT	HEAT TREAT	FINISH	

ECKEL VALVE CO.
SAN FERNANDO CALIFORNIA

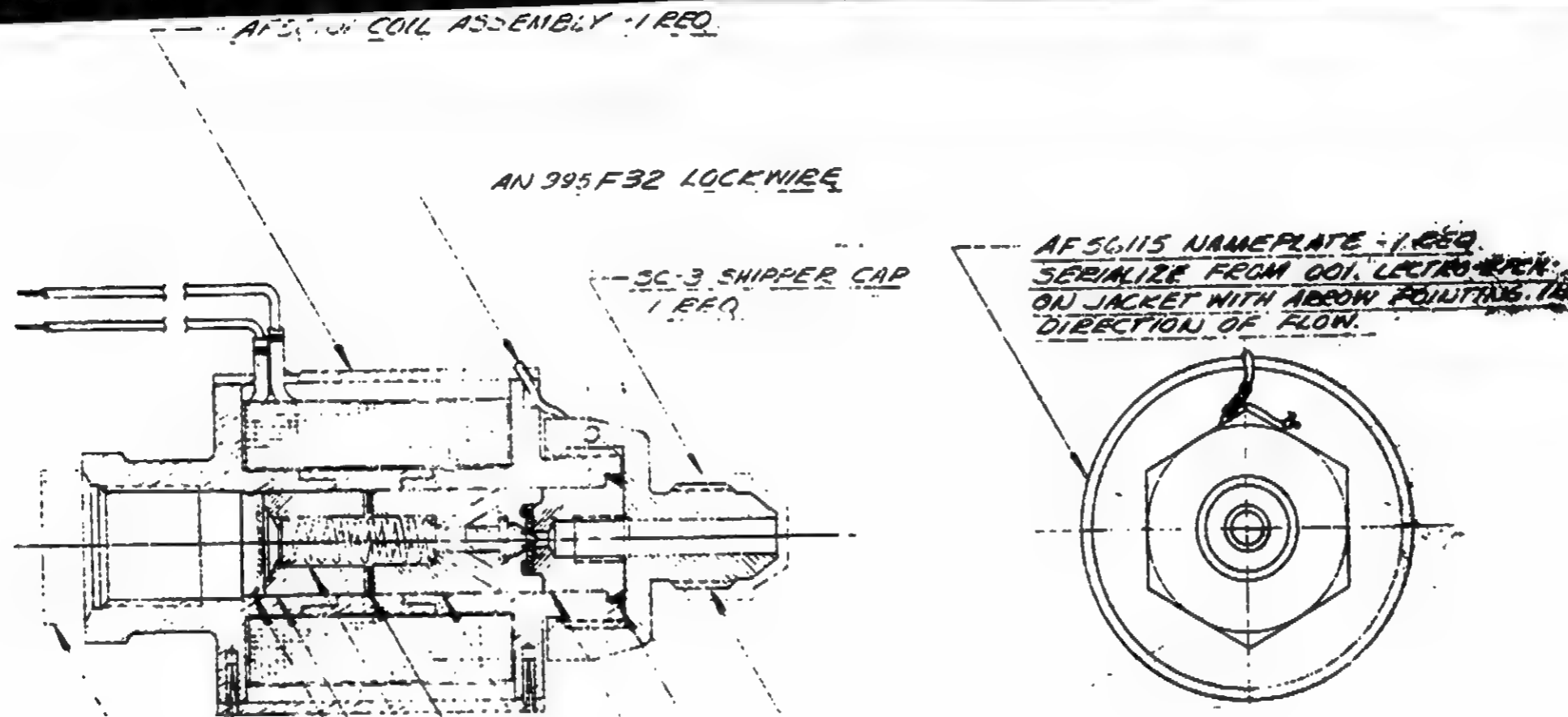
TITLE MANUFACTURING ASSEMBLY		DRAWING NO AF42M-562	
DATE 4-14-55		BY E.C.	

PRODUCTION

D	T103-15 WAS T103	939
C	ADDED T-144-1 WASHER 1 REQ	420
B	REVIEWED TO CALL IT	
A	COIL ASSEM. CAP ASSEMBLY	
ADDED NOTE		
CMG	DESCRIPTION	DATE



(2) Copies sent to...



- (F) T103-14 SCREEN - 1 REQ. INSTALL AFTER ADJUSTING STROKE.
- (F) AF 561907 STOP - 1 REQ. POSITION TO OBTAIN .028 STROKE OF POPPET COAT O.D. OF STOP LIGHTLY WITH LED PLATE 250 BEFORE PRESS IN IN BODY



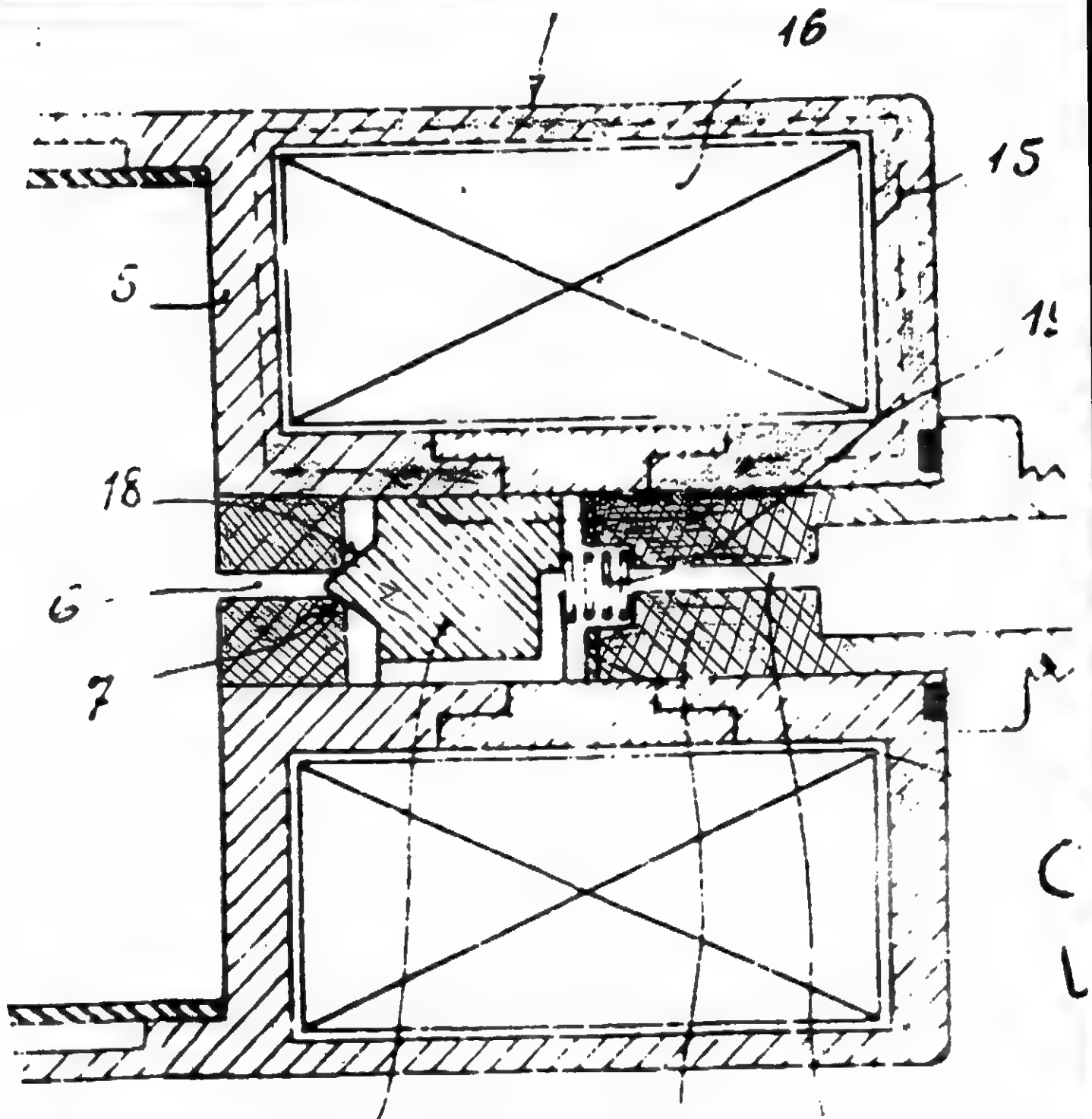
1	T-144-7	WASHER-DROP OUT
(F) 1	T-103-14	SCREEN
AS 250	LED PLATE 250	LUREL ANI
1	SP-4	SHIPPER PLUG
1	SC-3	SHIPPER CAP
AS 100	AN 995 F32	LOCKWIRE
1	AF 56115	NAMEPLATE
1	AF 56114	SPRING
(F) 1	AF 561907	STOP
(F) 1	AF 56104-1	POPPET ASSEM.
(F) 1	AF 5605-1	SEAT ASSEM.
1	AF 56108	SEAL
1	AF 56107	END CAP
1	AF 56101	COIL ASSEM.
REQ.	PART NO.	DESCRIPTION

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TOLERANCES UNLESS NOTED
Decimal $\pm .005$ Fractions $\pm 1/64$
Angular $\pm 1/2^\circ$
Dilled holes per AMS 10387
CONCENTRICITY
C = T.I.R. E = T.I.R.
Dress to be met before plating
Repeal all burrs
Break all sharp corners .005
All machine surfaces

DRAFTSMAN: HARTFIELD 9-24-54	CHECKER: H 10-30-54	APPROVED: JLC 11-4-54	MATERIAL:
WEIGHT:	HEAT TREAT:	FINISH:	
ECKEL VALVE CO. SAN FERNANDO CALIFORNIA			

TITLE: MANUFACTURING ASSEMBLY		DATE: 11-4-54
DRAWING NO. AF 56115-1		SCALE: 1:1



June 15, 1937.

A. F. HOPPE

2,084,030

COMBINED ELECTRICALLY AND HYDRAULICALLY CONTROLLED VALVE

Filed May 14, 1936

FIG. 1.

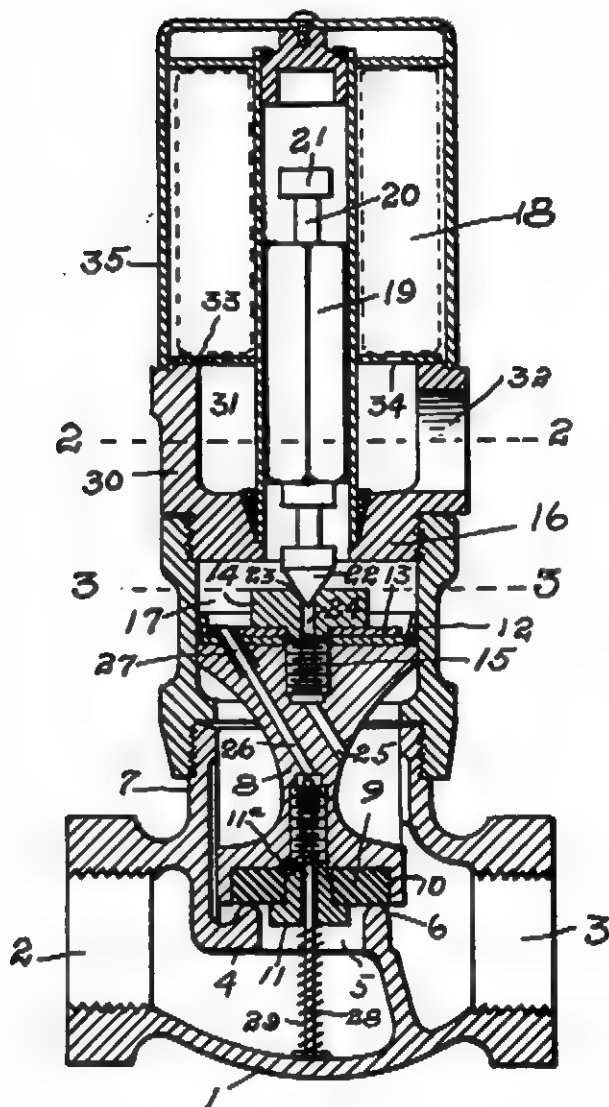


FIG. 2.

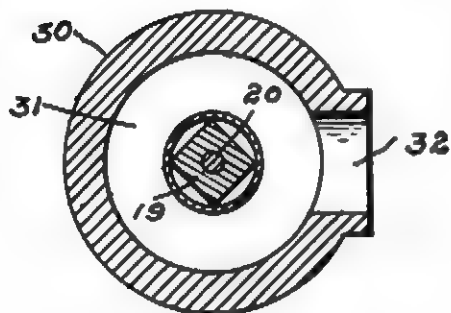
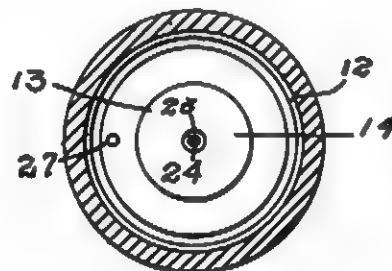
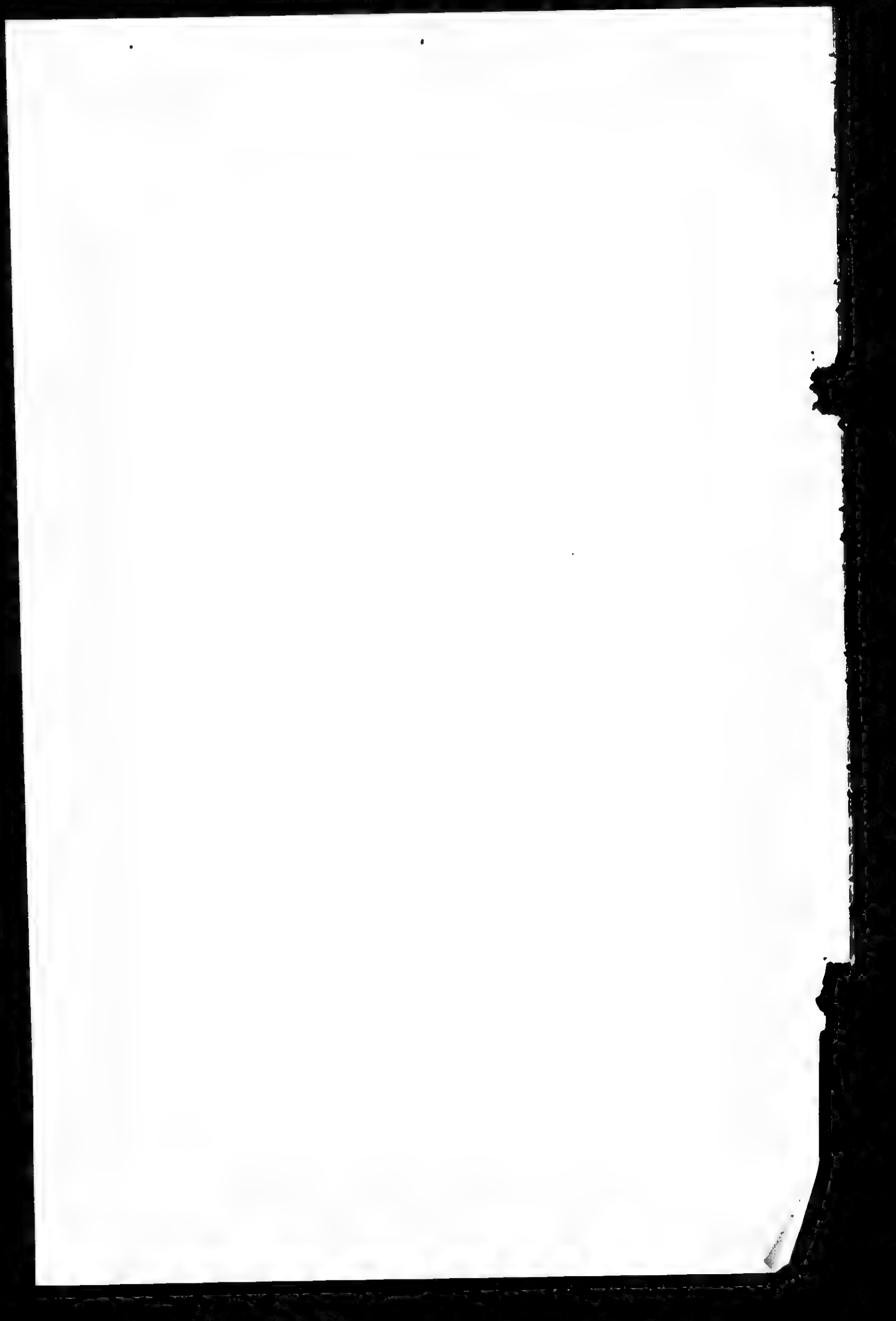


FIG. 3.





UNITED STATES PATENT OFFICE

2,084,030

COMBINED ELECTRICALLY AND HYDRAULICALLY CONTROLLED VALVE

Arnold F. Hoppe, Indianapolis, Ind., assignor to
E. C. Atkins and Company, Indianapolis, Ind.,
a corporation of Indiana

Application May 14, 1936, Serial No. 79,741

5 Claims. (Cl. 137-139)

This invention relates to combined electrically and hydraulically controlled valves of that type adapted for hydraulically controlling the passage of fluids therethrough.

One feature of the invention is the provision of a compression chamber in the valve body at a point above the valve whereby the pipe line pressure may be utilized for closing the valve.

A further feature of the invention is the provision of a valve carrying piston having both an inlet and an outlet passage therethrough.

A further feature of the invention is the provision of means for regulating the capacity of the inlet passage and preventing accumulation of foreign particles therein.

A further feature of the invention is the provision of electrically operated means for automatically controlling the outlet passage through the valve carrying piston.

A further feature of the invention is the provision of means for forming a splicing chamber between the compression chamber and the electrical operating means.

A further feature of the invention is the provision of means for maintaining the parts of the valve carrying piston in true alignment with the inlet passage therethrough.

In the accompanying drawing,

Figure 1 is a vertical transverse sectional view through the valve structure showing the valve closed.

Figure 2 is a sectional view thereof as seen from line 2-2, Fig. 1, and,

Figure 3 is a sectional view as seen from line 3-3, Fig. 1.

Referring to the drawing, 1 indicates the casing or valve body having an inlet opening 2 and an outlet opening 3, said openings being separated by means of a partition wall 4, said wall having an opening 5, around which is formed a valve seat 6.

Extending outwardly from the body 1 and communicating with the interior thereof is a cylinder 7, in which is mounted a valve carrying piston 8, to which is connected a valve 9 for cooperation with the valve seat 6.

The valve 9 is preferably entered in a recess 10 in the under face of the piston 8 and is held in position by means of a headed stud 11, which is threaded into the under face of the piston 8. Fitting over the upper face of the piston 8 is a sealing cup or ring 12, which is held in place on the piston by placing a plate 13 over the outer face thereof, said plate being in turn held in place by the head 14 of a threaded stem 15, said stem also threading into the piston 8.

The outer end of the cylinder 7 is closed with a removable cap 16, thus forming a compression chamber 17 between the piston 8 and cap 16 and as the cylinder 7 is of greater diameter than the

opening 5, and as a greater fluid pressure will form above the piston 8 than is passing through the pipe line to which the valve structure is attached, the line pressure will be overcome and the valve 9 hydraulically forced to closed position where it will be held so long as the pressure is held in the compression chamber 17.

The compression in the chamber 17 is controlled through the medium of a solenoid 18 of any preferred construction, said solenoid having a core 19 for operating a plunger 20. The plunger 20 is provided at its upper end with a head 21 and at its lower end with an auxiliary valve 22, which cooperates with a seat 23 on the outer face of the head 14, said seat fitting around the upper end of a port 24 in the head 14.

The port 24 registers with an outlet passage 25, formed through the piston 8, with its lower end communicating with the outlet end of the valve casing 1, so that when the auxiliary valve 22 is raised from its seat, the fluid in the compression chamber 17 will discharge and reduce the pressure in said chamber, whereupon the line pressure will raise the valve 9 and permit the fluid to flow directly through the valve casing.

The fluid is inducted into the compression chamber 17 through an inlet passage 26, also extending through the piston 8, the lower end of the passage 26 communicating with a port 11a in the stud 11 which in turn communicates with the inlet end 2 of the valve casing 1, the upper end of said passage communicating with the compression chamber 17 and through which the compression is built up in the compression chamber. As the upper portion of the passage 26 extends through the sealing ring 12 and plate 13, they are held in fixed relation with the piston 8 in any suitable manner, preferably by a tube section 27, one end of which enters the openings through the ring 12 and plate 13 with its opposite end entered in the passage 26 in the piston.

The capacity of the port 11a and incidentally the inlet passage 26 may be controlled in a suitable manner, preferably by means of a rod 28, one end of which is normally held seated against the lower inner wall of the casing 1 by means of a spring 29. The rod 28 extends upwardly into the port 11a and by providing rods of different diameters or studs 11 with different sized ports 11a, the capacity of the port and passage may be increased or decreased, thus controlling the speed at which the fluid will feed into the compression chamber 17 and incidentally timing the closure of the valve 9. As the piston 8 reciprocates and the rod 28 remains substantially stationary, the rod also serves to prevent the collection of any foreign particles in the port 11a and passage 26, thus preventing clogging of the passage and maintaining a uniform flow of fluid therethrough

at all times and insuring a uniform closure of the valve.

The cap 16 has a peripheral flange 30 thereon which forms a splicing chamber 31 between the cap proper and the lower end of the solenoid 18 for the storage of the spliced ends of the main wires (not shown) and the wires of the solenoid (not shown), an opening 32 being formed through the flange 30 for the introduction of the main wires.

A separating plate 33 is positioned between the solenoid 18 and upper end of the splicing chamber 31, said plate having an opening 34 for the passage of the wires from the solenoid to the splicing chamber 31, said solenoid being held in place by a housing 35.

In operation, with the parts of the valve structure in the position shown in Fig. 1, the valve is closed, but upon energizing the solenoid 18, the core 19 will be raised and when the core strikes the head 21, the auxiliary valve 22 will be released from the seat 23, which permits the fluid in the compression chamber 17 to escape through the outlet passage 25, thus releasing the hydraulic pressure above the piston 8, and as the passage 25 has an increased outflow over the inflow through the passage 26. When the pressure above the piston is released, the line pressure will force the main valve 9 from its seat 6, so that the fluid will freely flow through the valve structure.

As soon as the solenoid 18 is again de-energized, the core 19 and plunger 20 will descend and close communication through the outlet passage 25. The fluid now immediately begins to flow through the inlet passage 26 and as the compression accumulates in the compression chamber 17, the line pressure will be again overcome and the valve 9 forced against its seat 6, thus stopping the flow of fluid through the valve structure.

What I claim is:

1. In a valve structure, a body portion having an inlet and an outlet, a partition separating said inlet and outlet, said partition having an opening therethrough, a valve seat surrounding said opening, a cylinder associated with said body portion, a piston in said cylinder, said piston having an inlet passage therethrough, a valve carried by said piston, a stud for holding said valve in engagement with said piston, said stud having a port forming a continuation of said inlet passage, a rod like member entering the port from the lower end thereof, the lower end of said rod like member resting on the inner lower wall of said body portion, said rod clearing said port of foreign substances and determining the flow of fluid through said port.

2. In a valve structure, a body portion having an inlet and an outlet opening at its ends, a partition separating said openings, said partition having an opening therethrough, a valve seat surrounding said partition opening, a piston, a valve carried by said piston for cooperation with said seat, said piston having a passageway, a stud for holding said valve in position on said piston, said stud having a port communicating with said passageway, a substantially stationary rod like means extending entirely through said port when said valve is closed for regulating the flow of fluids through said passageway and port and pre-

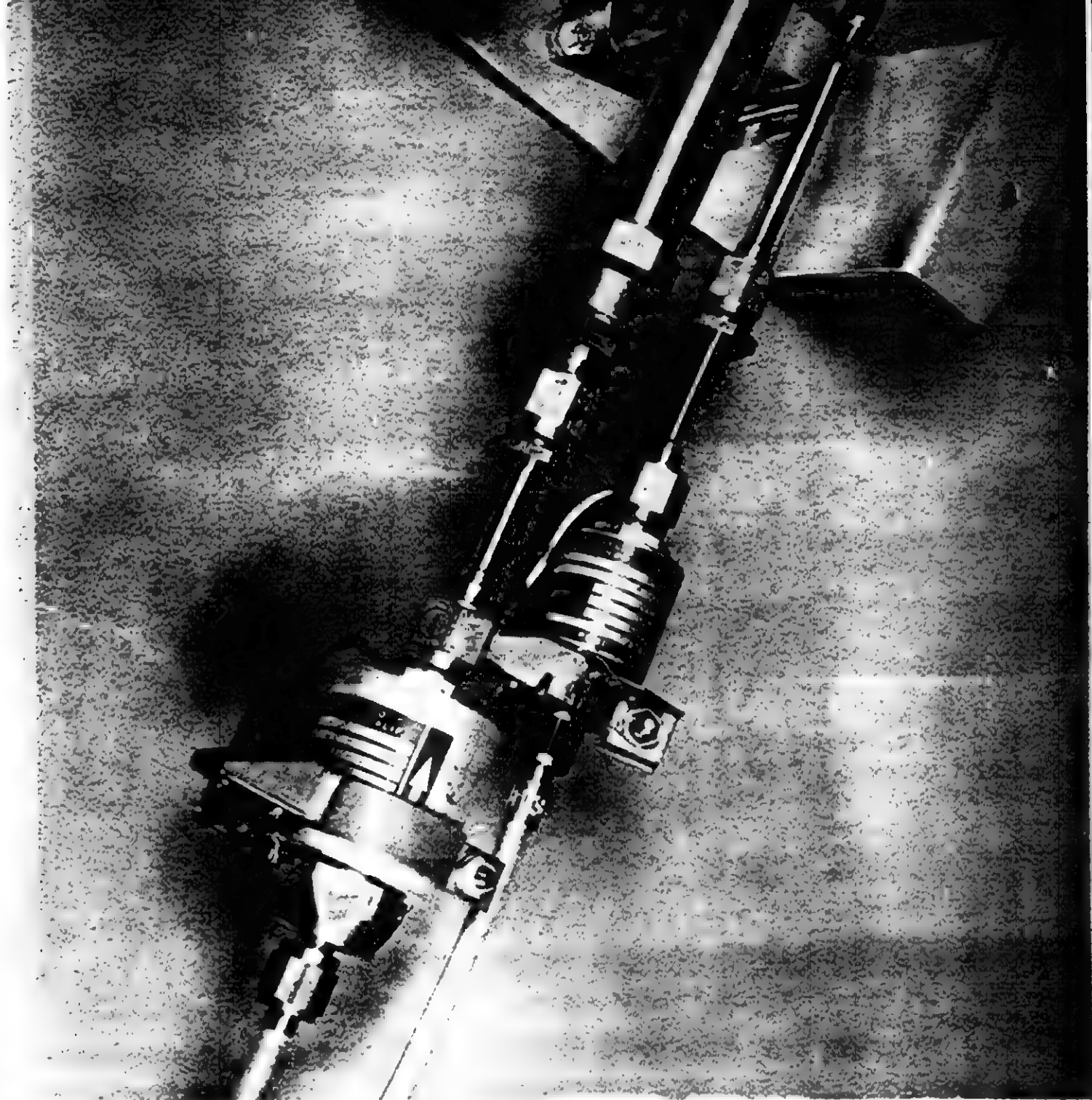
venting accumulation of particles in said port and passageway, the diameter of said rod like means being less than the diameter of said port, whereby liquid may continuously flow past said rod like member regardless of the open or closed position of said valve, a head at the lower end of said rod like means resting on the inner lower wall of said body portion, and a spring between said head and lower end of said stud for normally holding said rod like means substantially stationary.

3. In a valve structure, a body portion, a cylinder connected therewith, a piston in said cylinder having an inlet opening therethrough for the passage of fluid, and a rod member entering said inlet opening for controlling the passage of fluid and preventing the accumulation of sediment therein, a head at the lower end of said rod like member resting on the inner lower wall of said body portion, and yielding means between said head and lower end of said piston for normally holding said rod member substantially stationary, the cross sectional area of that portion of the rod entering said opening being of uniform diameter throughout its length and of less diameter than the diameter of said inlet opening, whereby a continuous flow of liquid through said inlet opening will result regardless of the open or closed position of said piston.

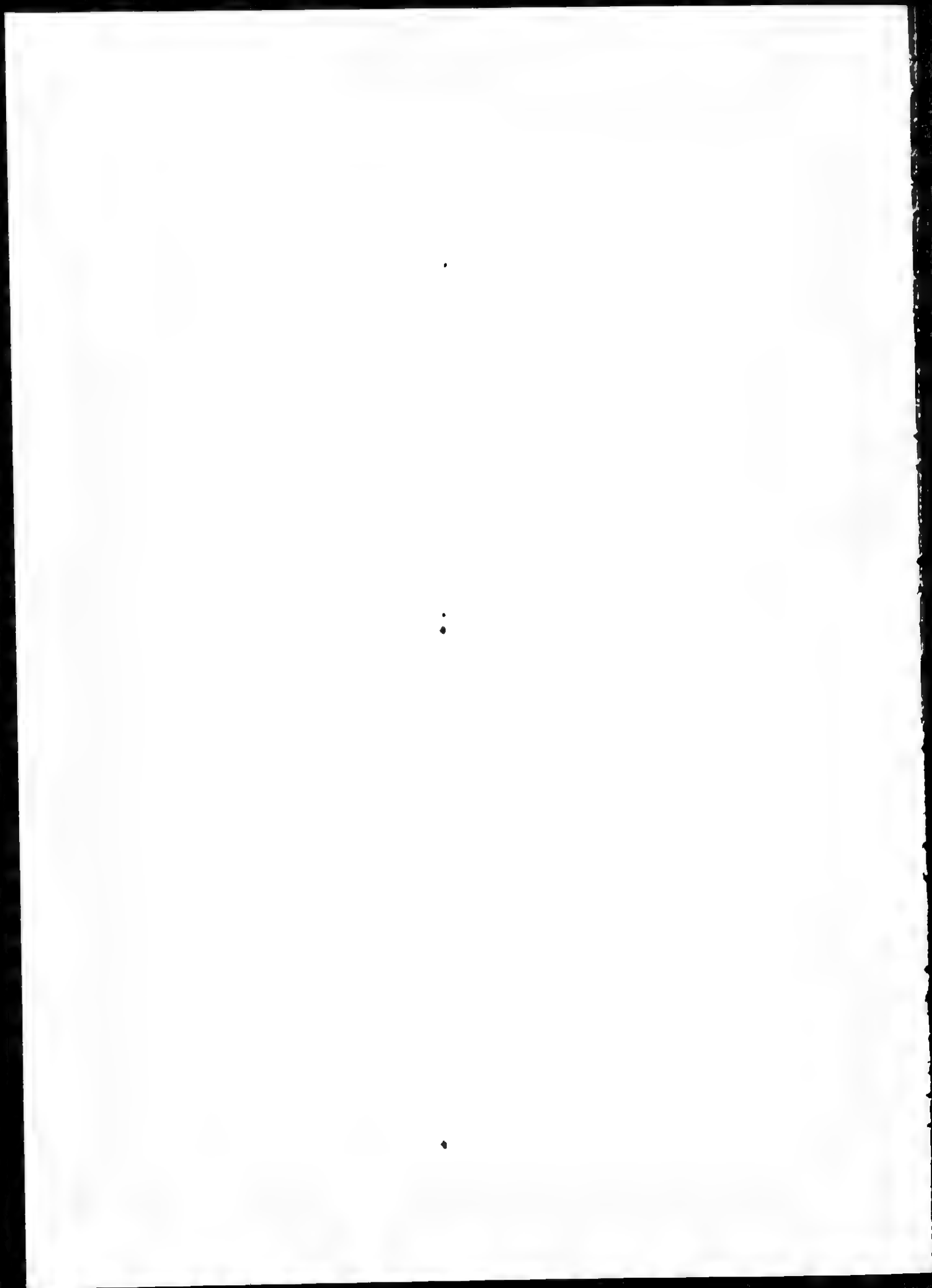
4. In a valve structure, a body portion, a partition in said body portion having a valve seat, a cylinder associated with said body portion, a piston slidable in said cylinder having an inlet and an outlet passage therethrough, a valve at the lower extremity of said piston for cooperation with the partition valve seat, a stud threaded into the lower axial portion of said piston for retaining said valve onto said piston, said stud having a port communicating with and forming a continuation of said inlet passage, a sealing cup above said piston, a headed stem threaded into said piston for securing the cup to said piston, said stem having a port forming a continuation of said outlet passage, an electrically controlled valve for closing said stem port, and a rod like member fitting loosely in the port of said stud, whereby liquid may pass through said port and inlet passage regardless of the position of said piston and valve carried thereby.

5. In a valve structure, a body portion, a partition in said body portion having a valve seat, a cylinder associated with said body portion, a piston slidable in said cylinder, said piston having an inlet passage for conducting liquid from the inner to the outer end of said piston, an outlet passage for conducting fluid from above said piston, an electrically controlled valve cooperating with said outlet passage for controlling the discharge of liquid therethrough, a valve carried by said piston for cooperation with said valve seat, and a rod like member entering said inlet passage from its lower end for determining the quantity of liquid passing through said passage and preventing the accumulation of foreign particles therein, said rod being loosely fitted in said passage and of uniform cross sectional area throughout its length whereby liquid will flow constantly and uniformly through said passage regardless of the position of said valve with its seat.

ARNOLD F. HOPPE 70



244





BELL AEROSYSTEMS COMPANY
BUFFALO 8, NEW YORK PHONE: NIAGARA FALLS BUTLER 5-7851

April 11, 1962

Mr. Vincent Eckel, President
Eckel Valve Company
1425 First Street
San Fernando, California

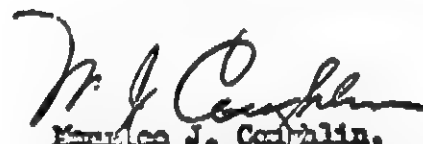
Dear Vince:

As one of our important subcontractors supporting the Mercury Program which culminated in the significant achievement of Col. John H. Glenn's orbital flight, it is our pleasure to forward to you, under separate cover, a Mercury capsule pin commemorating this event.

We know that you, as part of the Mercury team, are looking forward to the continuing success of the Nation's space program.

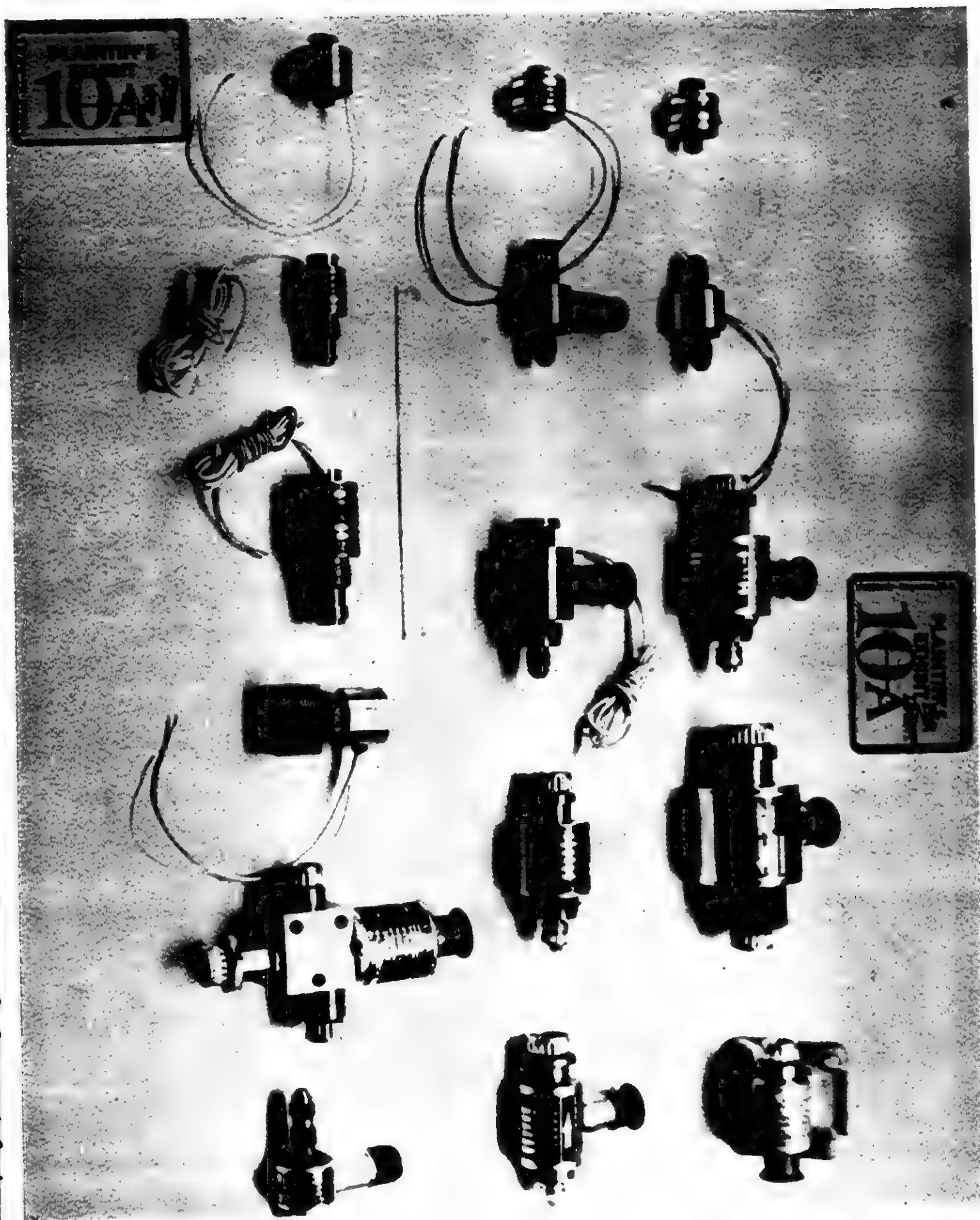
Cordially yours,

BELL AEROSYSTEMS COMPANY
Division of
Bell Aerospace Corporation


Emile J. Connelley,
Director of Procurement
Aerospace-Rockets Division

MJC:HEJ

245



VG4000A

PLAINTIFF'S
EXHIBIT

Magnetic VALVES

For Instant Positive Flow Control



- 1. Designed for aircraft, marine, automotive or stationary applications requiring explosion proof valves.
- 2. Meets the electrical, mechanical and operational requirements of Military Specification No. MIL-V-5781 (USAF) 14 June 1950.
- 3. Applicable to AN-F-42 fuels containing 0 to 30 per cent aromatics.
- 4. Valve operates properly over entire temperature range of -65° F. to 165° F.
- 5. Magnetic and spring-loaded valve action provides instantaneous flow or cut-off.
- 6. Liquid pressure over valve seat assures positive shut-off when valve is de-energized.
- 7. Valves close immediately in the event of a power failure.
- 8. Optional filter screen prevents foreign material from creating a mechanical failure. Screens are readily removed or inserted to suit a particular application.

VG4000A VALVES

VG4000A1 _____ With Screen

VG4000A2 _____ Without Screen

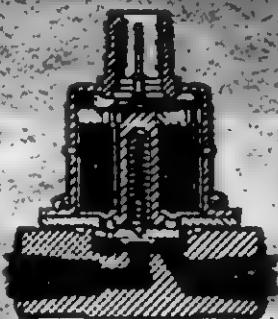
WRITE — AERONAUTICAL DIVISION, MINNEAPOLIS-HONEYWELL REGULATOR COMPANY
2747 4TH AVENUE SOUTH — MINNEAPOLIS 8, MINNESOTA



Description

HONEYWELL'S VG4000A MAGNETIC VALVE is specifically designed to produce the instantaneous "on-off" flow control demanded of hydraulic lines conveying petroleum products or other non-corrosive liquids. The valve provides electrical connection to a 24 volt dc coil through an internally grounded, double-prong AN receptacle. Inlet and outlet ports are tapped for straight threads (1/4-20NF-3). An optional inlet filter screen prevents foreign materials from obstructing the internal mechanism. Valve deterioration, due to "storage age," is averted by stamping a metal tag with the "curing date" of the oldest rubber component in each valve. Available models are listed in the table below.

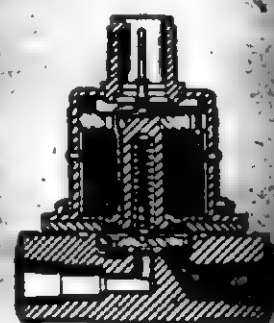
Operation



OPEN POSITION

This particular Honeywell magnetic valve (V) is operated by a 24 volt dc power source which energizes the magnetic coil, lifting the seal-off disc from the valve seat and retaining it in the "open" position as required for a given application. Upon removal of power, the magnetic field collapses and the spring-loaded seal-off disc is instantly compressed against the valve seat to cut off the liquid flow. In the "closed" position the inlet flow is diverted across the top of the seal-off disc to create a faster, more positive seal and to neutralize almost all adverse vibration forces.

* Other magnetic valves available in 6 to 12 volts dc with a single-prong AN connector or a screw-type terminal post. The filter screen is optional in all models.



CLOSED POSITION

Installation

VG4000A VALVES are easily installed in aircraft, marine, automotive or stationary installations and are operable in any mounted position. Four blind tapped screw holes (No. 6-32) in the base of the valve provide for mounting to a rigid structure. Maximum installation dimensions are shown in the diagram below.

Specifications

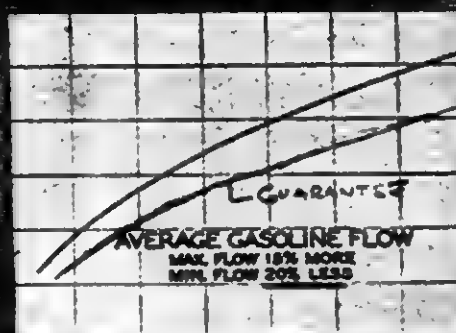
Pipe Threads (inlet & outlet ports)...Straight- 1/4-20NF-3
 Maximum allowable pressure.....40 psi
 Maximum operating pressure.....35 psi
 Power consumption (approx.).....10 watts
 Voltage requirements.....24 vdc
 Weight (approx.)......63 lb.
 Meets military requirements set forth in MIL-V-5781 (USAF) June 14, 1960.

FLOW RATES

Pressure drop	1/2 psi	1 psi	3 psi	5 psi	7 psi
Gasoline (lbs. min.).....	1.3	1.9	3.4	4.35	5.5
Air (cu. ft. min.).....	.7	1.05	2.05	2.9	3.7



1.5" MIN. CLEARANCE FROM SURFACE TO WHICH MOUNTED



CUSTOMER: *John J. ...*
ADDRESS: *Los Angeles, Calif.*

OR- 82221

CONTACTS: *Jim H. ...*

PART NO. *11*
MODEL NO.

TYPE OF BUSINESS: *Air Conditioning Unit*
Submitted by: *C. S. ...*

DESCRIPTION and type of unit
... 20933, ...

11 FOR	QUANTITY	REQUESTED DELIVERY
12 QUOTATION	100	Per month min.
13		
14		
15		
16		

PLANNING
ENGINEER
170

PROMISED DELIVERY (FROM P.O.)	DEL. AUTH.	PRICE AUTH.	FORWARD DATE

17	AIRCRAFT	INDUSTRIAL
18 END USE	ARMY, NAVY, CIA, X	CONSUMER, O.E.M.
19	MODEL NO. <i>...</i>	USED ON
20 POTENTIAL	NO. PER SHIP, KNOWN SHIPS	IMMED., ANNUAL
21	ANTICIPATED SHIPS, UNKNOWN	UNKNOWN
22 STATUS	EXP., NEW PROD., SPARES, RESEARCH	
23	CONVERSION, TO REPLACE	
24 COMPETITION	STIFF, FAIR, NEGLIGIBLE, NON-COMPETITIVE	
25	APPROX. PRICE UNIT WILL BRING <i>...</i>	IN <i>...</i> PC. LOTS
26	COMPETITIVE UNIT <i>...</i>	
27	PRICE RANGE OF COMPETITIVE UNIT <i>...</i>	TO <i>...</i> QTY.

28 REFERENCES	<i>...</i>
29	<i>...</i>
30	<i>...</i>
31 ENCLOSURES	CUST. DWS. NO. <i>...</i> CORRESPOND.
32 REQUIREMENT	CUST. DUE DATE, SCHEDULED, FWD'ING DATE
33	DESIGN LAYOUT
34	DRAWING NO. <i>2/15</i>
35	PROTOTYPE
36 REQUEST	NO AVAILABLE, SHEARHEAD UNSUITED, INSUFFICIENT POTENTIAL
37 DENIED	COMPETITION, UNIT TOO SPECIALIZED, DESIGN TOO INVOLVED
38 BECAUSE	REMARKS: <i>...</i>

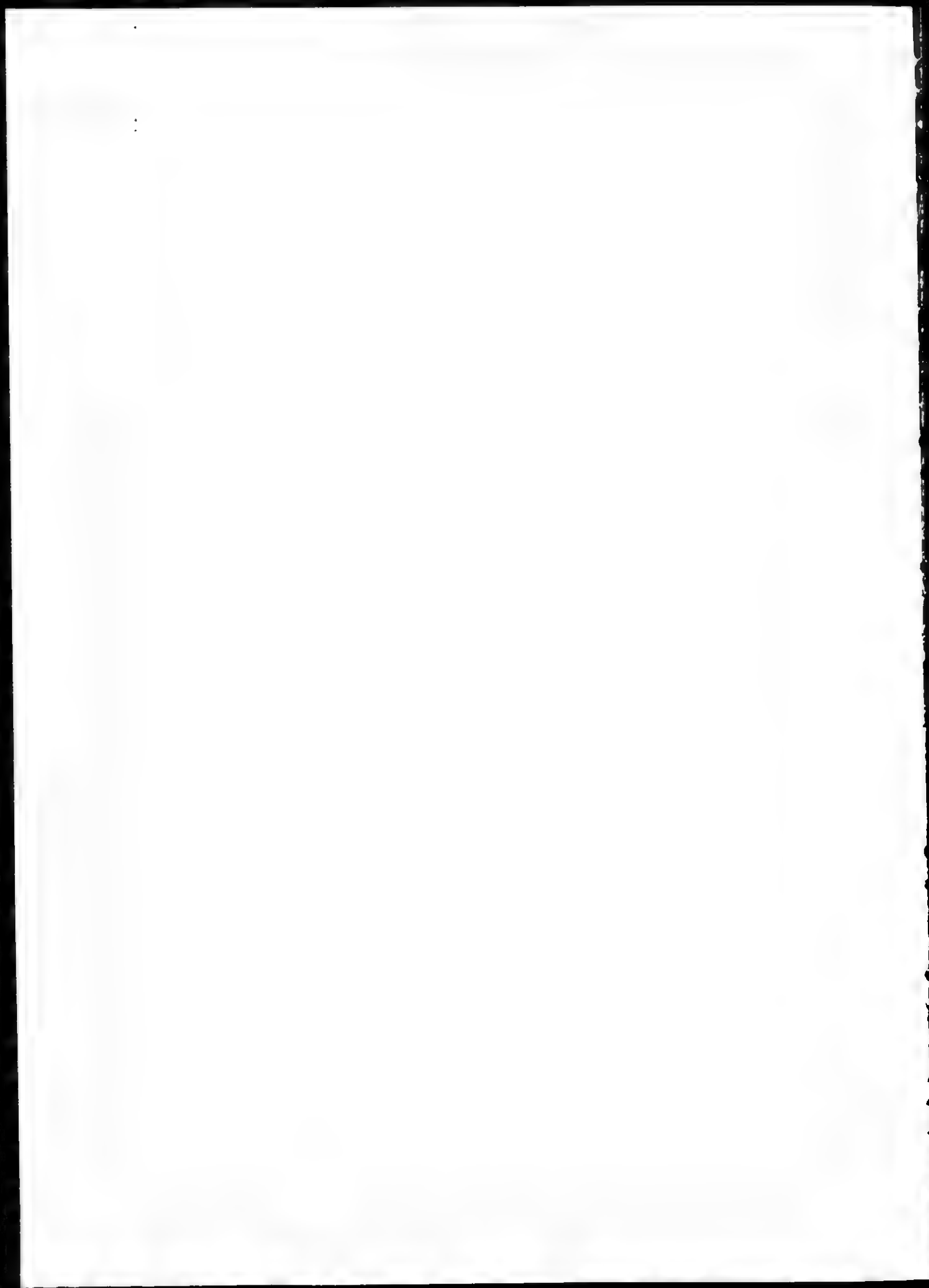
41	ENGINEERING DATA
42 SERVICE	HYD, FUEL, AIR, WATER, OTHER
43	TEMP. OF MIN. <i>...</i> MAX. <i>...</i> MAX. ALLOWABLE WEIGHT <i>...</i>
44	MAX. ALLOWABLE LEAKAGE, DROPS PER MINUTE <i>...</i> CPM PER MIN.
45 RATED FLOW	CPM, GPM, CPM (FREE AIR), LBS. PER HR., AT <i>...</i>
46	INCH <i>...</i>
47	MAX. ALLOWABLE PRESS. DROP, PSI AT <i>...</i> FLOW, GPM ETC.
48 PORTING	ON, INPT 1/2, INOUE, MALE, FEMALE
49	OTHER <i>...</i>
50 SHAFT END	HAVAL STD., BAE BERR., OTHER
51	HANDLE RECD., MAX. ALLOWABLE LENGTH, INCHES
52 OPER. PRESS.	MAX. <i>...</i> PSI, MIN. <i>...</i> PSI
53	MAX. TORQUE AT <i>...</i> PSI PRESS., IN. LBS., OR LBS. AT END OF HANDLE
54 ACTUATING	HANDUAL, PRESSURE, MOTOR, SOLENOID X
55 PRESSURE	ACTUATING PRESS. TO FULLY CLOSE (OR OPEN) <i>...</i> TO <i>...</i> PSI
56 ACTUATING	AT OPERATING PRESS. OF <i>...</i> TO <i>...</i> PSI
57 DATA	CRACKING OR RESET PRESS. <i>...</i> TO <i>...</i> PSI
58 ELECTRICAL	SPECIFY: AC, DC X, MAX. AMP., MIN. AMP.
59 ACTUATING	VOLTAGE, MIN. <i>...</i> MAX. <i>28</i> CYCLE
60 DATA	VALVE DUTY CYCLE, <i>...</i> SECONDS, OFF <i>...</i> SECONDS
61	HANDUAL OVERRIDE, YES, NO X, MOVED, ELECTRIC RESET, TYPE <i>...</i>
62	EXPLOSION PROOF RECD., NORMALLY OPEN, NORMALLY CLOSED X
63 SPECIAL	LIMIT STOPS, DETENTS, NEUTRAL POSITION, NIP
64 FEATURES	OTHER

Comments and Sketches (Sketch flow diagram and identify ports pressures for all operating positions.

1. Use 20933, cut off carburetor boss and shorten body 3/3 to 1/2 in.
2. Valve would have many applications in heater fuel system, if designed to handle fuel also.
3. Allowable leakage of .001 to .005 lb./min. but zero if possible.
4. Used on Constellation and CV-240 as turbine relief valve and regulator dump valve. Every pressurized airplane has or is expected to have a Landing Gear Cabin Press. relief valve. Aircorsearch is shipping 25 - 30 units per day which could use this.
5. Competitive units are:
 - a. Minneapolis-Honeywell at 9-1/2 oz. - 3.00
 - b. General Controls at 8 oz. (10.00 ea but it has metal seat and leaks.
 - c. Adel at 6 oz. - 10.25 ea, lots of 1-100 13.00 ea lots of 100 or more.
 - d. Pacific Airotive at 4 oz. - can't buy because they use it on competitive unit.
6. They would like weight of 1-5 oz. max. and believe it can be done because Pacific Airotive does. Couldn't give information on their design however.
7. Could use as small as 1/16 passage for that requirement, but believe for overall picture should design for 1/8 max. passage.
8. This valve also should have applications for fuel valve on Janitrol heaters. (Surface Combustion)

FEB 1 1949

ENG. COPY



REQUEST FOR QUOTATION

TP's 12

AiResearch MANUFACTURING COMPANY

A DIVISION OF THE GARRETT CORPORATION
 9851 - 9951 SEPULVEDA BOULEVARD LOS ANGELES MUNICIPAL AIRPORT
 LOS ANGELES 45, CALIFORNIA

Req. No. _____

Date June 7, 1951

- V. E. Eckel
- 506 N. Hollywood Way
- Burbank, California



ITEMS SUBJECT TO INSPECTION

- ☐ Air Corps ☐ at Source
☐ Navy ☐ Destination
☐ Airesearch

F.O.B. _____

THIS IS NOT AN ORDER

Gentlemen:

You are invited to submit quotations on the following items subject to the factors checked above and the delivery information given. Prices shall include all charges for packing and shipping to the F.O.B. point noted. Quotations shall remain in effect for 60 days unless otherwise noted. If these items should be ordered from you, it is understood that the purchase order shall be subject to conditions on reverse side of this quotation request.

This form must be filled out and returned to Purchasing Department by _____ if bid is to be considered. Attached are _____ prints which must be returned with this quotation.

By Phil Brown *Phil Brown*
 Purchasing Dept.

DATE REQUIRED AT QUANTITY	ITEM	QUANTITY	DESCRIPTION	PRICE	DISC.
10/1/51	1	600	Only #AF-10B Solenoid Valve		
<div style="position: relative; height: 200px;"> <div style="position: absolute; bottom: 10px; left: 10px;"> PPBrown:mrs 6/7/51 </div> <div style="position: absolute; bottom: 10px; right: 10px;"> <i>Cartons attached to original</i> </div> </div>					

INVOICES ON ABOVE ITEMS SUBJECT TO THESE TERMS

Delivery, if other than as requested, to be _____

Prices quoted subject to withdrawal _____

Date of this Quotation _____

By _____ date _____

VENDOR'S AGENT

ORIGINAL COPY—Return to AiResearch Manufacturing Company

TITLE OR CAPACITY

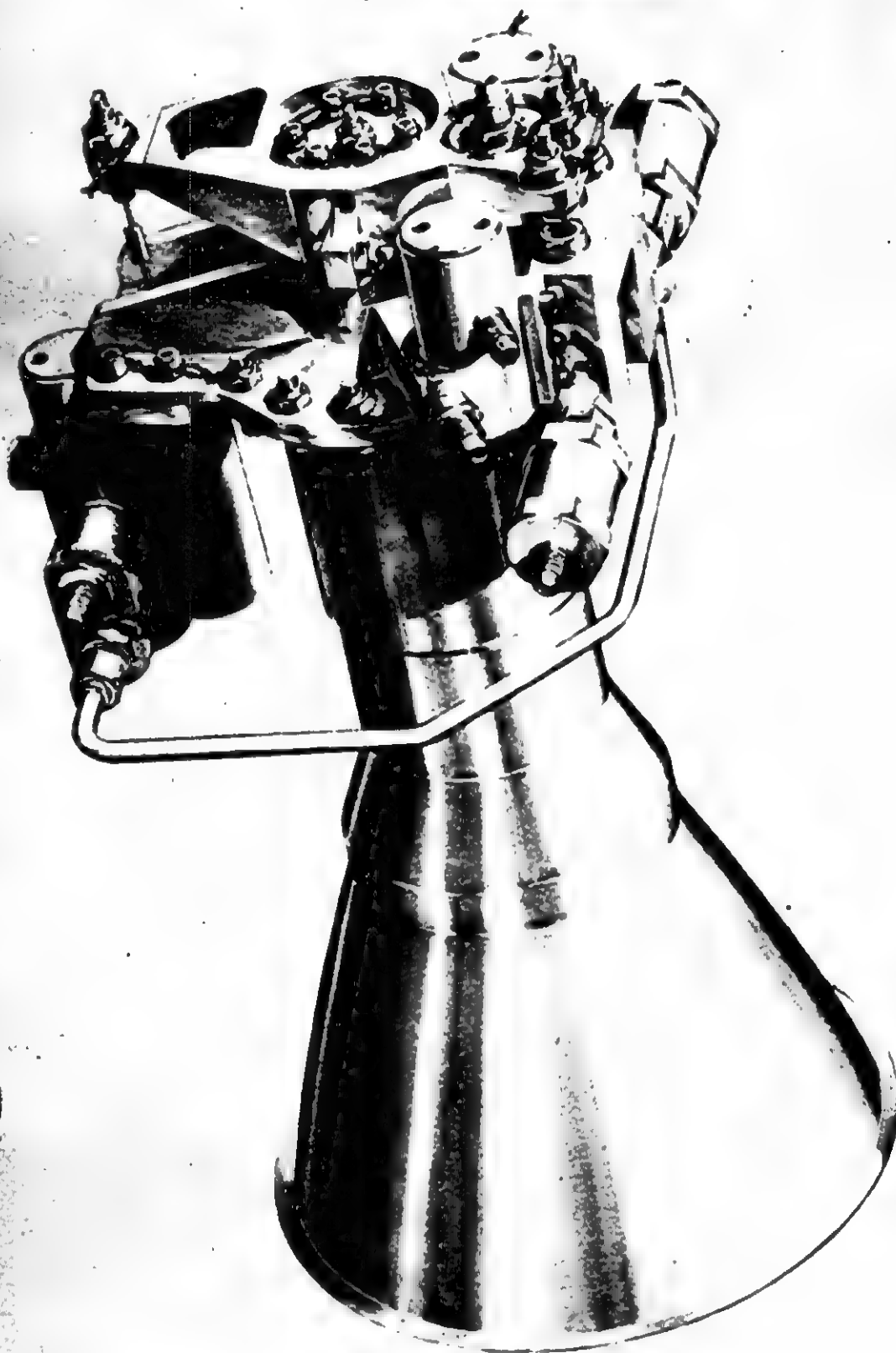
SURVEYOR

LEADER LANDING MECH. ECT

13



12-13-50-1

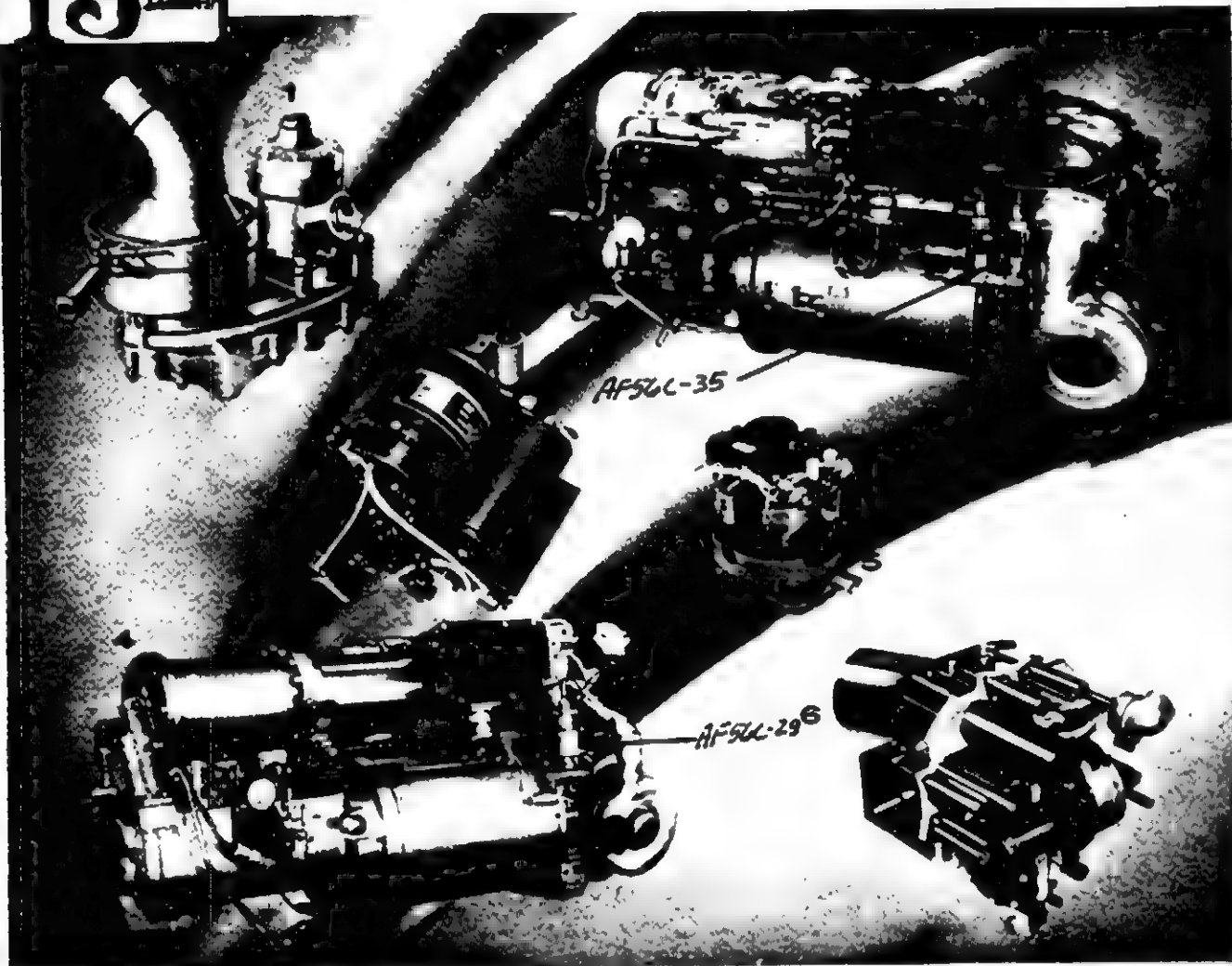


STL
VARIABLE ORIFICE
ROCKET ENGINE. 12-13-50-1

PLAINTIFF'S
EXHIBIT
1-4
FOR
IDENTIFICATION

ECK
VAL
CO

DELIVERED—thousands of missile APU's



1. Solid propellant—hydraulic output 2. Liquid propellant—hydraulic and electric output 3. Solid propellant—electric and mechanical drive output
4. Liquid propellant—hydraulic and electric output 5. Solid propellant—hydraulic and electric output
6. Solid propellant—hydraulic, electric and steering outputs

AiResearch has designed, developed, manufactured and delivered thousands of missile accessory power units. Extremely reliable and lightweight, these various solid and liquid monopropellant APU's are completely self-sustaining within the missile system. Designed to minimum space and weight requirements, they are built to withstand high G loading and severe temperature extremes.

The several units pic-

tured above provide hydraulic, electrical and/or steering surface control depending on the customer's requirement. Delivered horsepower ranges from 1.2 to 35 h.p. over hot gas operating durations from 30 seconds to 20 minutes. Electrical regulation is maintained as closely as $\pm 1\%$. A significant advance in missile APU's is unit #6 pictured above. This package represents the first integrated hydraulic and electrical power unit providing

a steering surface actuation system.

These tailored systems utilize the extensive hardware experience and complete laboratory, test and production facilities of AiResearch needed for quick and efficient quantity production of complex APU systems. AiResearch is the world's largest and most experienced manufacturer of lightweight turbomachinery—the key component of its APU systems. Your inquiries are invited.

THE GARRETT CORPORATION



AiResearch Manufacturing Divisions

Los Angeles 45, California • Phoenix, Arizona

Systems, Packages and Components for: AIRCRAFT, MISSILE, ELECTRONIC, NUCLEAR AND INDUSTRIAL APPLICATIONS

May 1959 • *Astronautics* 53

- eckel valve co. -

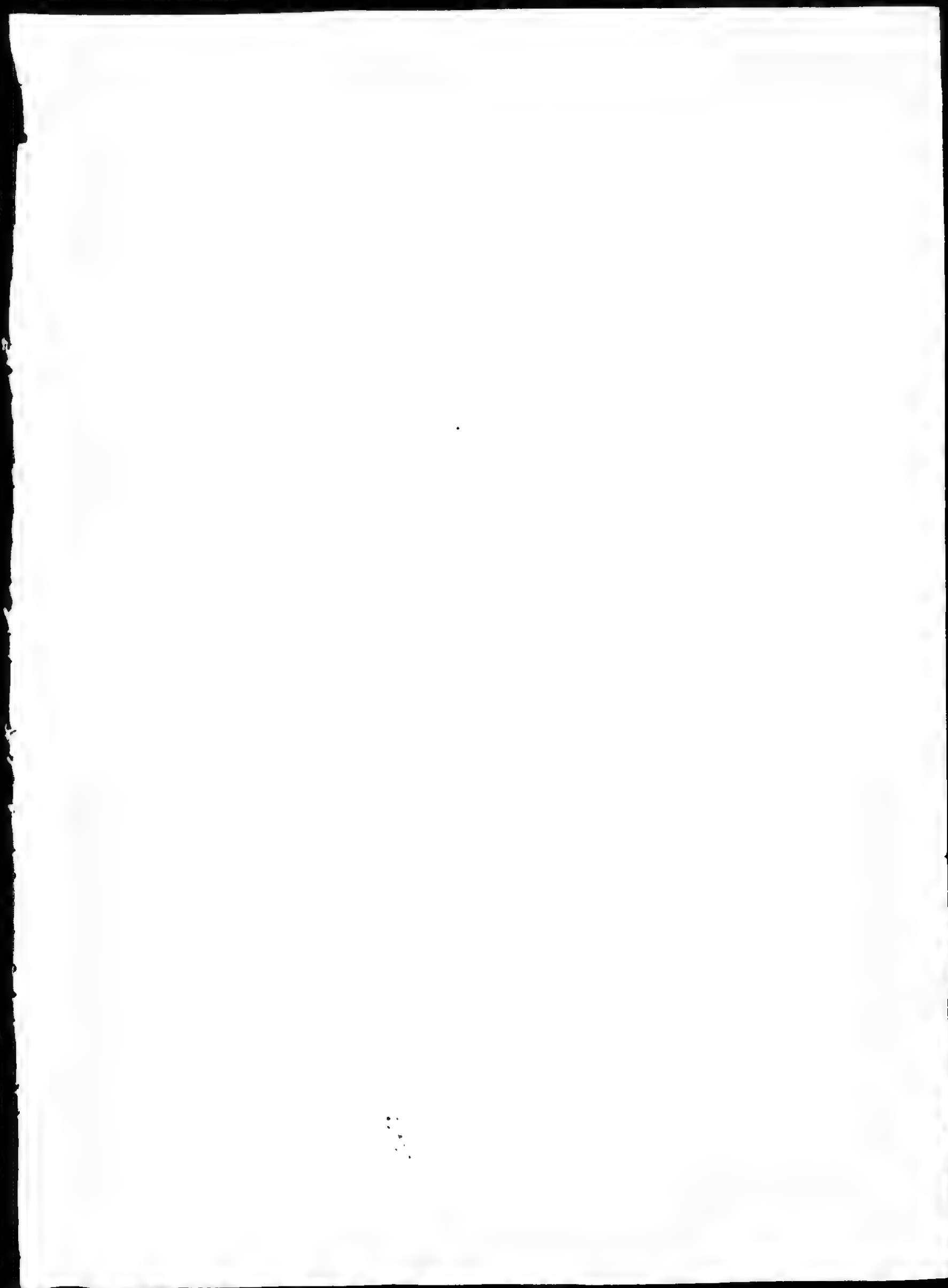
AEROSPACE APPLICATIONS

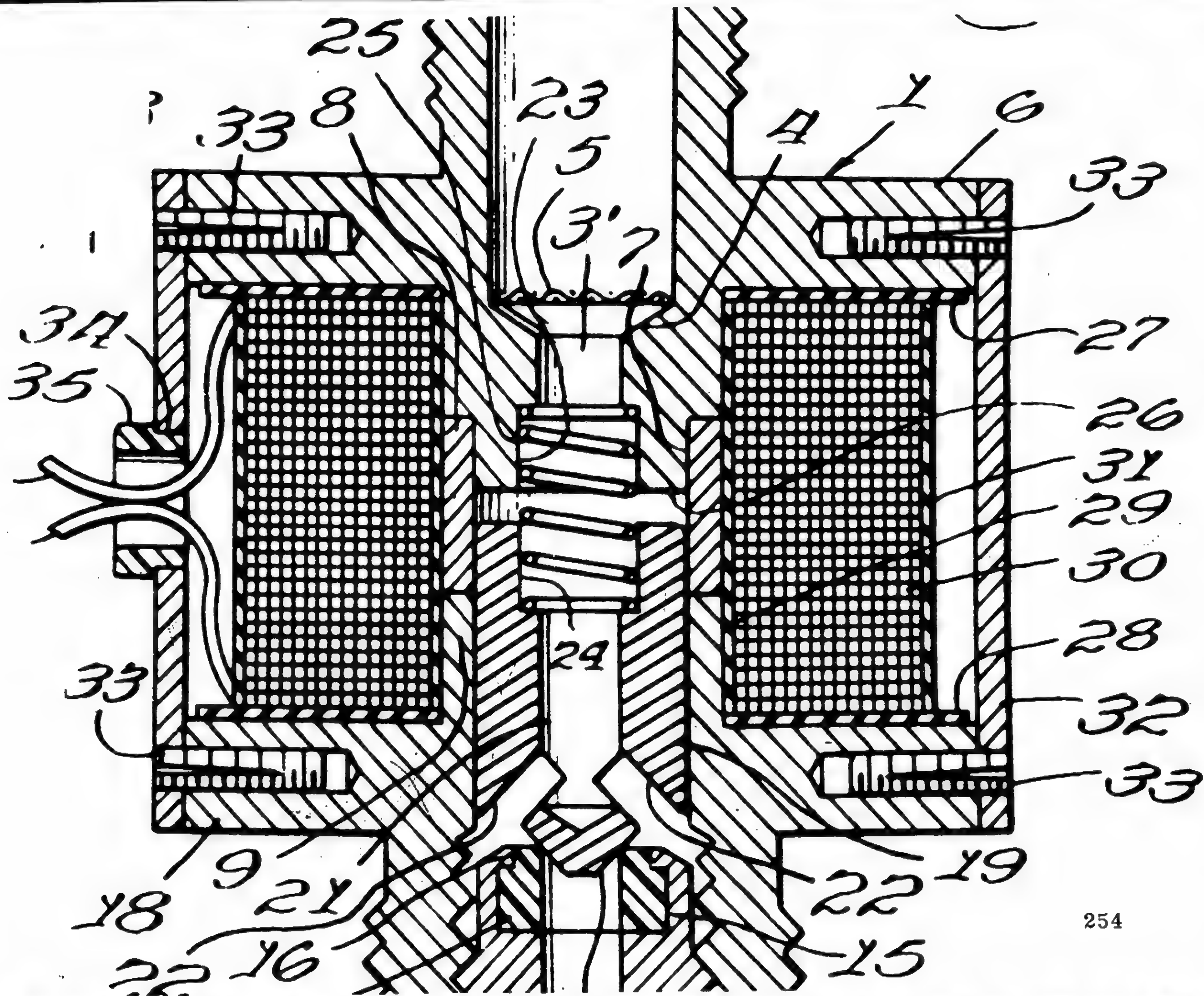
<u>VALVE #</u>	<u>COMPANY</u>	<u>APPLICATION</u>	<u>VEHICLE</u>
AF77C-A-27	AiResearch	Oxygen breathing valve	GEMINI
AF37C-6	AiResearch	Environmental control system	GEMINI
AF77-A27	AiResearch	Blood Pressure Measuring system	MERCURY
AF56C-67, AF102C-13	Bell Aerosystems	H ₂ O ₂ Attitude Control	MERCURY
AF77C-21	McDonnell	Chimp Couch	MERCURY
AF15C-7, AF108C-5	Bell Aerosystems	H ₂ O ₂ Attitude Control	CENTAUR
AF108C-5B, AF15C-17	Convair Astro.	H ₂ O ₂ Attitude Control	CENTAUR
AF42C-8	General Elec. MSVD	Bio-physics System	DISCOVERER (Nose Cone)
AF42C-112	Crumman Aircraft	Pressurization System	ECHO II
PT77C-1, PF77C-1	Beckman Instruments	Helium Subsystem for The Gas Chromatograph	SURVEYOR
AF35C-1, BF62C-5, BF62C-7	Fairchild Camera	Camera lens defogging & deicing system	CLASSIFIED SPACE VEH.
AF59C-45, AF56C-12, AF102C-47, AF59C-39, AF77C-A13	Wright Aero. Div.	Hydrozine, UDMH, N ₂ Spacecraft Attitude Control Systems	CLASSIFIED
AF35C-10, AF77C-28A	Nortronics	Heat Exchanger	SKYBOLT
BF14C-16	Aerojet-Sacramento	RP-1 Valve on Engine	TITAN I
AF63C-10, AF62C-2	Robertshaw-Fulton	Fueling System Helium Regulator	TITAN II
BF14C-6A, AF14C-14	Aerojet-Sacramento	Aerozine Pilot Valves	TITAN II

- eckel valve co. -

AEROSPACE APPLICATIONS

<u>VALVE #</u>	<u>COMPANY</u>	<u>APPLICATION</u>	<u>VEHICLE</u>
AF77C-A-27	AirResearch	Oxygen breathing valve	GEMINI
AF37C-C	AirResearch	Environmental control system	GEMINI
AF77-A27	AirResearch	Blood Pressure Measuring system	MERCURY
AF56C-67, AF102C-13	Bell Aerosystems	H ₂ O ₂ Attitude Control	MERCURY
AF77C-21	McDonnell	Chimp Couch	MERCURY
AF15C-7, AF109C-5	Bell Aerosystems	H ₂ O ₂ Attitude Control	CENTAUR
AF102C-5, AF15C-11	Convair Astro.	H ₂ O ₂ Attitude Control	CENTAUR
AF42C-C	General Elec. NSV	Bio-physics System	DISCOVERER (Nose Cone)
AF42C-117	Grumman Aircraft	Pressurization System	ECHO II
PF77C-1, PF77C-1	Peckman Instruments	Helium Subsystem for The Gas Chromatograph	SURVEYOR
AF35C-1, BF62C-5, BF62C-7	Fairchild Camera	Camera lens defogging & deicing system	CLASSIFIED SPACE VEH.
AF59C-45, AF56C-13, AF102C-17, AF59C-3, AF77C-A13	Wright Aero. Div.	Hydrozine, UDMH, N ₂ Spacecraft Attitude Control Systems	CLASSIFIED
AF35C-10, AF77C-23A	Mortronics	Heat Exchanger	SKYBOLT
BF14C-16	Aerojet-Sacramento	RP-1 Valve on Engine	TITAN I
AF63C-10, AF62C-2	Robertshaw-Fulton	Fueling System Helium Regulator	TITAN II
BF14C-6A, BF14C-14	Aerojet-Sacramento	Aerazine Pilot Valves	TITAN II





Sept. 29, 1942.

O. FUSCALDO

2,297,399

INTERNAL COMBUSTION ENGINE FUEL INJECTOR

Filed Nov. 21, 1939

2 Sheets-Sheet 1

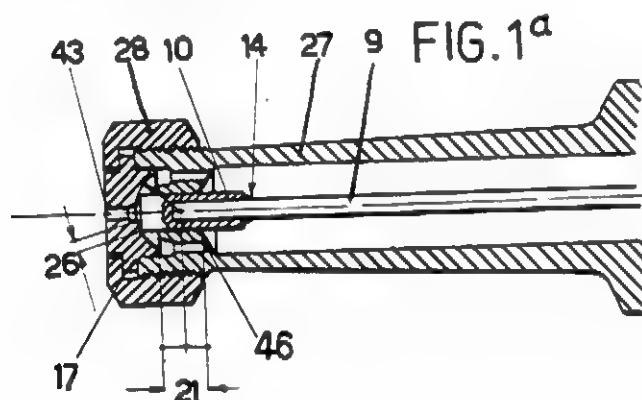
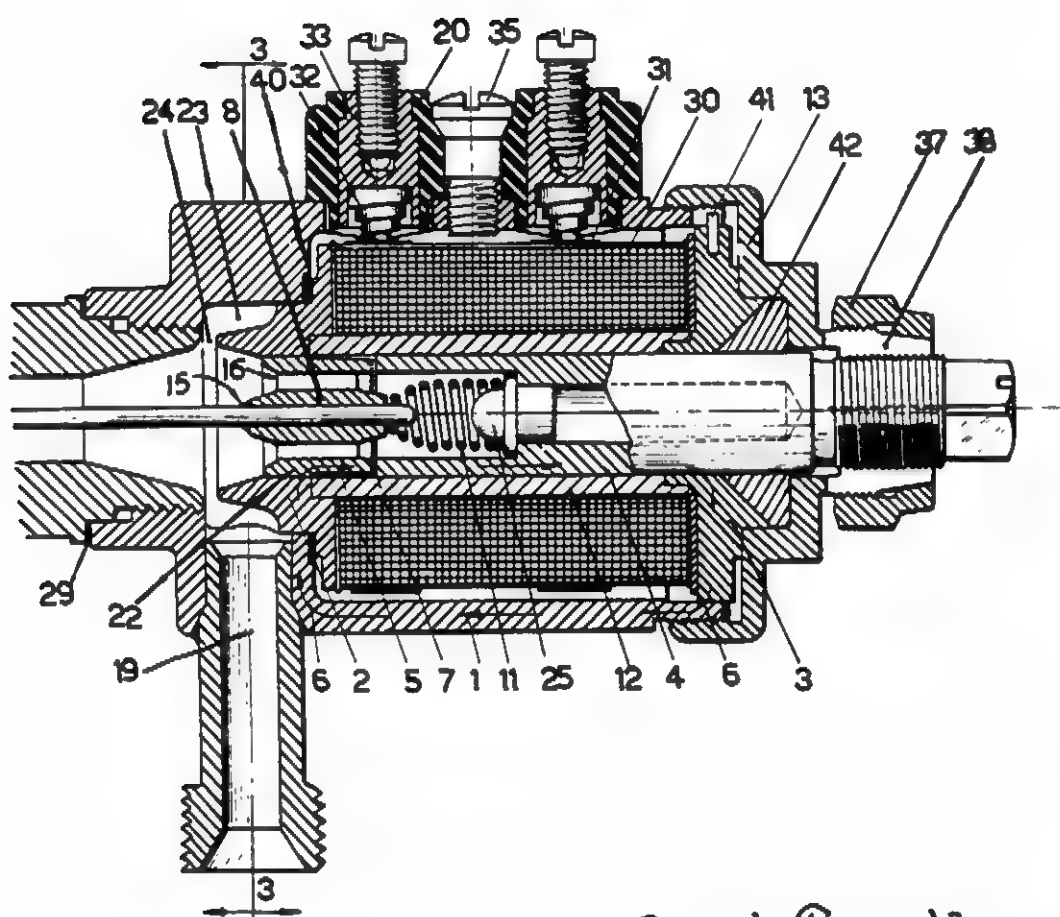


FIG. 1^b



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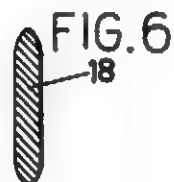
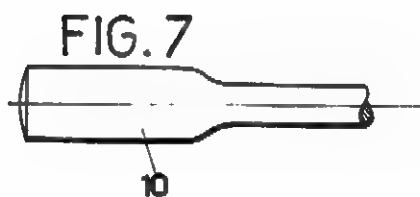
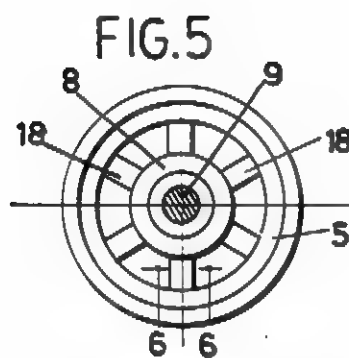
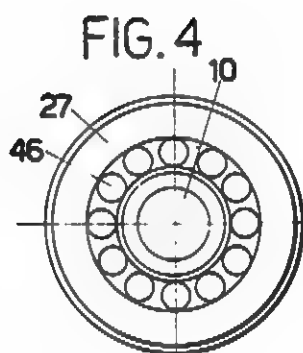
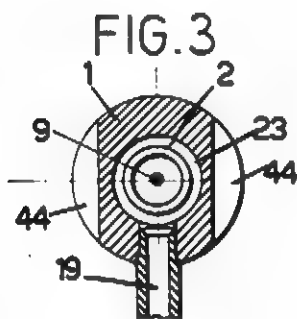
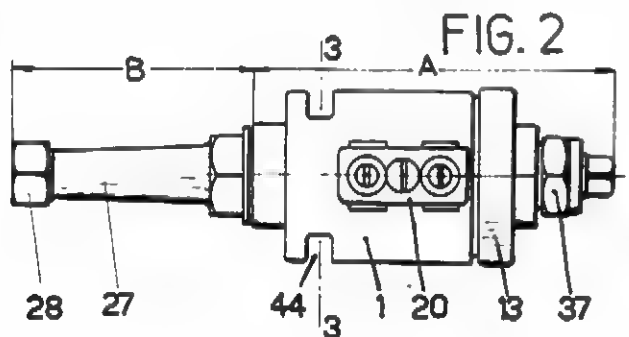
O. FUSCALDO

2,297,399

INTERNAL COMBUSTION ENGINE FUEL INJECTOR

Filed Nov. 21, 1939

2 Sheets-Sheet 2



Ottavio Fuscaldo
Inventor
by Morrison Kennedy & Campbell
Attorneys

UNITED STATES PATENT OFFICE

2,297,399

INTERNAL COMBUSTION ENGINE FUEL
INJECTOROttavio Fuscaldo, Milan, Italy; vested in the
Alien Property CustodianApplication November 21, 1939, Serial No. 305,419
In Italy January 20, 1939

5 Claims. (Cl. 137-139)

This invention is for improvements in or relating to internal combustion engine fuel injectors and is concerned with an electromagnetically operated injector of the type comprising a magnetic means or solenoid working in opposition to a spring for opening and closing the valve. In the illustrated form is shown, in combination, a movable armature or core, preferably subject to a yielding control, solid with a valve stem and valve controlling the fuel outlet-nozzle, an electric winding for creating a magnetic flux in a magnetic circuit for periodically attracting the armature, thus closing the magnetic circuit, the magnetic circuit being formed entirely of magnetic material and the movable armature being operable independent of the action (pressure, viscosity, etc.) of the liquid fuel.

An electromagnetically controlled injecting system may comprise an injector or a number of injectors of the described type, a current distributor, a fuel-feeding apparatus delivering to the injector or to the injectors and a fuel-flow controlling apparatus. The efficiency of the system depends entirely on that of the ejector, especially at high speeds.

The main object of the invention is to provide highly efficient electromagnetic injectors, which entirely solve the faults of injection systems hitherto employed.

The electromagnetic injector has a distinct advantage over hydraulically or mechanically controlled injectors, avoiding the inherent defects thereof. It should, therefore, operate perfectly with high frequency injections, at very short intervals, as required by modern two-stroke and four-stroke engines, maintain its characteristics for long periods of operation, have such standard designs of parts as allow an easy reproduction on a manufacturing scale, and be capable of easy operation and maintenance.

In order that the electromagnetic injector can operate with high frequencies and exactly predetermined injections, even in a very short time and requiring the lowest possible current, it should:

- (a) Be very highly efficient;
- (b) Have very light moving parts;
- (c) Have moving parts capable of moving very rapidly within the compressed fuel in which it is immersed;
- (d) Have very small friction between the moving parts and the fixed parts;
- (e) Have a very short valve stroke combined with a tight closure of the nozzle.

In order that the injector should maintain correct fuel delivery for a long period of operation, it is necessary (f) that the friction and percussion surfaces should be very hard and that (g) the inner parts in contact with the fuel should be stainless.

The injector should also be (h) readily demountable and adjustable by mechanics of average skill, without requiring the services of a specialist, and, finally, the construction should be of such a nature (i) that all the injectors built by mass production have identical characteristics. Thus, several injectors of a single multi-cylinder engine have practically equal fuel deliveries at all engine speeds.

In order that the invention may be readily understood an example thereof will be described with reference to the accompanying drawings, in which:

Figs. 1^a and 1^b together constitute a longitudinal sectional view on an enlarged scale of an injector constructed according to the invention;

Figure 2 is a plan view of Figs. 1^a and 1^b on a reduced scale;

Figure 3 is a cross section along the line 3-3 of Figures 1^b and 2;

Figure 4 shows an enlarged end view of the guiding device of the valve;

Figure 5 is an end elevation of the movable armature or core;

Figure 6 is a cross sectional view of a wing or spoke of the armature along the line 6-6 of Figure 5; and

Figure 7 illustrates a modified construction of the valve.

Referring to the drawings, the magnetic circuit of an injector according to the invention comprises a housing wall or shroud 1, end extensions or flanges 2 and 3 therefor, a solenoid coil or winding 30, a central and preferably fixed armature or core 4 adjustably shiftable for adjusting the lift or travel of a valve 10, and a ring 5 (moving armature) fast upon or rigid with stem 9 of the valve.

The parts forming the magnetic circuit of the electromagnet are of very pure iron, having high magnetic permeability and very small coercive force and hysteresis, since the iron must magnetize rapidly as soon as the coil is energized and must demagnetize as rapidly and as completely as possible when the exciting current circuit is broken.

The magnetic circuit is indicated in Figure 1^b by arrows 6, the only gap therein being in the axial end-clearance 7 between the fixed arma-

ture 4 and the moving armature 5, which clearance corresponds exactly to the stroke of the valve.

When the coil is energized, the movable armature 5 is attracted by the fixed armature 4 so that the end clearance is reduced to zero and the magnetic circuit closes. The side or radial clearance between the moving armature 5 and flange 2 guiding it, although minute, is a harmful gap which is required, however, for permitting the free shifting motion of sliding armature 5. This gap should be as small as possible, both for reducing to the utmost the reluctance of the magnetic circuit, by reducing the resistance to the magnetic flux through the thin film of fuel filling the whole cavity of the injector, and for reducing to a minimum the difference in thickness of the thin film at diametrically opposed points, when the armature 5 will be slightly displaced from the centre of flange 2; this second reduction reduces the concentration of the flux where the gap is least, which causes a side-attraction of the armature 5 with consequent appreciable losses due to friction.

Another undesirable gap appears in the side clearance between the fixed armature 4 and flange 3, but it can be reduced to a negligible value, since the armature 4 is not intended to slide freely as is the ring 5, but should only be thrust from the outside with a slight movement and only when adjusting the stroke of the valve.

The moving armature 5 is ring-shaped as is preferably also the end of the fixed armature 4 facing it. This effects a concentration of the magnetic flux on the two poles facing each other, causing them to saturate magnetically so as to increase to the utmost the attractive power of the electromagnet. Moreover, as the hub 8 connecting the ring armature 5 to the stem 9 of the valve 10 is made of non-magnetic material, for example bronze, and, for reasons stated hereinafter, since the stem 9 and the spring 11 are of tempered steel, this will prevent magnetic flux from dispersing in any great quantity in the stem and spring. On the contrary, the resilient spring 11 bears in opposition to the attractive force with its smallest convolution at the conical end thereof seated on the hub 8 projecting within the cavity of the hollow fixed armature 4.

As distinguished from the inside members 4 and 5 of the electromagnet, the enclosing wall 1 and flanges 2 and 3 are very thick so as easily to collect the lines of force, which, otherwise, would mainly tend to pass through the outer air, thus increasing the reluctance of the magnetic circuit.

Flanges 2, 3 have extending between them, surrounding the cores 4, 5, a tube 12, forming therewith a bobbin or spool on which the solenoid wire is wound. The tube 12 is made of non-magnetic material such as bronze and, therefore, receives no magnetic flux, which entirely passes through gap 1.

The housing or shroud 1 is closed by a screw-threaded end-cover 13, holding the bobbin in position. The end-cover 13 is also made of bronze, otherwise, if it were of iron as is the armature 4, the threads might in time be stripped because of adjustment, pure iron being very soft. If, however, it were made of steel, it would magnetize permanently and thereby impair the operation of the electromagnet.

The above precautions satisfy the condition (a) relating to high efficiency of the electromagnet.

With regard to condition (b) concerning the reduction in weight of the moving parts of the apparatus, this condition must be satisfied to ensure that the electromagnet is instantaneously attracted and to utilise to the utmost advantage the possibility of obtaining a quick opening of the valve.

The very light moving parts close the fuel flow through the combined thrust of the spring 11 and the pressure of the fuel which flows in the injector in the direction of closing, thus to offer the least resistance to the rapid closure of the valve. The light weight also reduces the shock at the end of the stroke caused either by abutment against the fixed armature or against the valve seat 17. In terming the thrusting device 11 a spring, this is intended to cover any analogous elastic or resilient device operable to restore the moving parts or close the valve; although under suitable conditions the liquid pressure might be operative to close the valve without an additional elastic device.

The injector is preferably made in two main parts, see Fig. 2, one part A enclosing the electromagnet and remaining outside the engine, and the other part B, forming the guide-piece and the seat of the valve which enters into the engine as far as required to bring the injection nozzle into the most convenient position in the combustion chamber according to the prevailing circumstances.

For this purpose the moving parts have a predetermined length and, in order to make this entity as light as possible, the connection of the valve 10 with the hub 8 which supports the armature 5 is formed by a very thin stem 9. Experience has shown that a solid rod of tempered steel is preferable for light weight and dimensions, consistent with resistance and rigidity. A hollow stem would be inadequate, due to the very slight forces it has to withstand.

Stem 9 is pressed into the bronze hub 8 and into the valve 10, the latter also being made of tempered steel; in order to increase the factor of safety, soft solder is added at the points 14 and 15.

As an alternative, as shown in Figure 7, the valve and stem can be made in a single piece, turned or ground out of a small rod.

The armature 5 is forced on to the wings or spokes of the hub or spider 8 and, for greater safety, is soft-soldered thereto at points 16 corresponding to the outside edges of wings 18.

The moving parts must, in accordance with condition (c) be capable of moving very rapidly and at a high frequency within the fuel under pressure which fills the chamber inside of the injector. Around hub 8 therefore are provided large free passages for the liquid between the two ends and the hub is small and displaces the least possible liquid without turbulence.

For the same purpose the inside left edges of the armature are chamfered, the wings 18 on the hub 8 are very thin and have tapered ends as shown in Figures 5 and 6, the hub 8 has tapering ends, the soldered parts 14 and 15 forming fillets, and the pitch of the spring 11 is equal to or even greater than the thickness of the wire.

It is also preferable that the fuel inlet into the injector should be between the moving armature and the nozzle so as not to force the fuel through the armature in its flow towards the nozzle, as such a passage, under violent impulses, would slow down the opening of the

valve and delay the beginning of the injection. The arrangement should be such as to leave some liquid practically stagnant in the neighbourhood of the moving armature and spring.

It is also very useful to shape or stream-line the fixed parts between which the fuel flows before being sprayed out of the nozzle, to prevent or minimize turbulent flow. For this purpose the interior surface of the nozzle piece 17 is made concave and preferably spherical, the valve guide is tapered towards the nozzle and all the edges of the valve and of the nozzle are rounded out.

Condition (d) concerning reducing as much as possible the friction between the moving parts and the fixed part is required not so much for reducing wear, as for obtaining a greater speed in opening and closing the nozzle, equal attractive force of the electromagnet and pressure of the spring being assumed.

Among the many causes of friction, neglecting that due solely to the weight of the moving parts and to faulty design or workmanship, are:

1. An uneven distribution of the magnetic flux around the moving armature 5 of the electromagnet, due to excessive clearance or to the pressure of unsymmetrical holes or recesses in the shroud 1. In order to avoid the latter cause, the connecting hole or part for the entrance of the fuel by bronze pipe 19 is placed diametrically opposite to the recesses required for mounting the current supply terminal 20 (which terminal block is mounted on insulating material) so as to provide compensation or balancing of metal.

2. The difficulty of obtaining proper and perfect alignment between parts A and B of the injector. This difficulty is overcome by guiding the moving part of the injector at the end of the parts A and B, by means of guides formed in the very short portions 21 and 22, so short that they can assume the necessary inclination even when the clearances in the guides are very small. Notwithstanding the inclined position the invention secures the tightness of the valve closure as will be described hereinafter.

3. The side thrusts against the stem 9 caused by the fuel entering by impulses in the injector from the pipe 19. Such blows are avoided by causing the fuel to enter firstly into an annular chamber 23 and then from the latter into the central cavity of the injector through an annular passage or slot 24, coaxial with the stem 9.

4. Imperfections in the spring 11; when not properly centered on armatures 4 and 5 the spring does not keep straight enough and the bearing ends thereof are not parallel and square with the centre-line, or when the hardening is not uniform etc., side pressures in the armature 5 may arise. To overcome such possible difficulties centering devices are provided on the hub 8 by having stem 9 projecting, and on the armature 4 by means of a bronze plug or seat 25, the latter also contributing to a certain extent to the insulation of the spring 11 from the armature 4. The left hand end of the spring being conically shaped, it bears centrally on the hub 8 so as to compensate for unavoidable imperfections in construction.

5. The use of the same soft metal (soft iron) for the flange 2 and the armature 5. This would tend to cause seizure after a short period of operation. To prevent this, the surfaces are chromium-plated, this having further advantages set forth below.

The coefficient of friction of chromium against

chromium being very low, the ability of the armature 5 to slide easily within flanges 2 is improved.

The requirement (e) of a short valve stroke and a tight closure of the valve are achieved, according to the invention, in the following manner. The tightness of the valve closure should be ensured even when the valve is slightly inclined due to imperfect alignment of parts A and B of the injector. To this end, whilst the guide 21 is placed very near to the seat of the valve, for reducing the friction, the seat itself is shaped as a hollow spherical cup, the spherical centre of which is preferably placed about half-way along the length of the guide 21 on the centre-line of the injector. The seat or the annular bearing 26 for the valve 10 has a rather small slope which is particularly favourable for effective valve lift, as it appears clearly that with the same effective section of the nozzle the lift of the valve is less the smaller is the slope of the seat thereof.

A further advantage of the spherical seat is that it is possible to grind it true and polish the surface by the same methods as are employed in preparing glass lenses, so as to avoid circular grooves concentric with the nozzle.

With regard to condition (f) concerning the provision of very hard friction and percussion surfaces, it is very important that once the injector is adjusted, it should maintain for a long time its original performance of constant volume of flow, there being assumed equal frequency and time of the injection, equal voltage of the current supply and constant density and viscosity of the fuel. For this purpose the clearances of the moving part within the guides 21 and 22 (to prevent existing friction from varying) and also the stroke should remain constant.

According to the invention this is obtained by employing very hard friction and percussion surfaces.

For the friction surfaces, the valve in the guide 21 is made of tempered steel and the guides of hard gun-metal; the guide 22, armature 5 and flange 2, being of very soft iron, are surface-hardened by an electro-plated layer of chromium, avoiding any heat treatment which might change the good magnetic properties of the iron.

As to the percussion surfaces, they are made of tempered steel for valve 10 and for the nozzle piece 17, sufficient for maintaining them in good conditions within safe practical limits. The mutually facing annular zones or ends of the soft iron armatures or core parts 4 and 5 are hardened by an electro-plated layer of chromium deposited with such care as to prevent it from peeling-off under continual percussion. To prevent the iron being caulked down under the layer of chromium the annular surfaces of the iron are initially hardened by mechanical rolling down or by any other suitable process.

The requirement (g) of freedom from oxidation of the inside surfaces in contact with the fuel is achieved as follows: Since the material should only be unattacked by the usual fuels, the parts of tempered steel and of bronze are practically corrosionless. On the contrary, the iron surfaces of the shroud 1 and of the flanges 2 which are not chromium-plated, as stated above, are protected with a light electro-plating.

The design of the apparatus in two parts A and B is particularly convenient both with regard to unified mass production and with regard

to ease in assembling and fitting and in adjusting etc. according to conditions (h) and (i).

Part B can be unscrewed from part A and then screwed-on again, when required for cleaning, without changing the original adjustment of the valve stroke; the screwing on again of the parts should stop at a point previously marked-off, and any errors thereby incurred are quite negligible.

A washer 29 inserted between the two parts A and B is made of a material having a hardness equal to that of annealed copper, thus excluding the use of any plastic material.

The adjustment of the stroke of the valve (axial clearance 7) is obtained by screwing in or out the armature 4 relatively to the cover 13. For fixing the armature 4 in a desired position after adjustment, a nut 37 threaded in to the projection 38 of cover 13 is tightened. This nut has a conical extension surrounding the slotted conical extension 38 of the cover or cap 13, so that tightening the nut locks the threaded extension of the adjustable core 4 within the cover, without causing any radial pressure. This is very important for correct adjustment since otherwise a simple locknut or double nut screwed on to the armature 4 would cause a longitudinal movement of the armature, corresponding to the eventual clearance existing between the threads; while a lateral set-screw would shift the armature eccentrically.

It is clear that the above described adjustment can be brought about from the outside, even during the operation of the engine and by any known control means.

The nozzle piece 17 is fixed on the nozzle-carrier or chamber wall 27 by means of a union or nut 28 and can be easily removed, if necessary, for cleaning, and it can be replaced in position without altering the valve stroke and it can also readily be changed for another piece when required to alter the diameter of the injecting nozzle or orifice member 43.

The bobbin or spool formed by the tube 12 and end extensions 2 and 3 carries the winding 39 of insulated wire. This coil has on the outside thereof two thin strips 31 of silver or of silvered copper or the like, acting as contacts, to which are soldered the two ends of the winding conductor. The conducting springs 32, preferably of silvered false-gold, fixed to the two current input terminals 33 bear against the two contact strips 31.

The two terminals 33 are incorporated in an insulating block 29 secured to the shroud by a central screw 35.

The injector may be fixed to the engine by means of two brackets, not shown, entering into the lateral slots 44 of the shroud, seen in Fig. 2.

The bobbin, as stated above, is secured within the shroud by means of the threaded cover 13. A gasket 48 of any desired plastic material is placed between the end wall 2 of the bobbin and the interior end of the shroud to prevent the fuel from entering into the chamber of the bobbin, while a pin 41 projecting from end wall 3 into a slot in the shroud prevents the bobbin from rotating and wearing against the gasket 48 when the cover is being screwed home.

A gasket of graphitic asbestos 42 or of any other suitable material prevents the fuel from flowing out along the outside of core 4, but allows the core to be screwed in and out for adjustment.

The perfect coaxiality of the shroud 1 of the cover 13 and of the bobbin is of paramount im-

portance in order that during adjustment the core 4 can slide in a straight line. For this purpose centering slots are provided as shown in the drawing.

A similarly perfect coaxiality is necessary between the guide 21 of the valve and the nozzle 17 having a spherical seat and to this end the guide is in one piece with the fuel pressure chamber or nozzle-carrier 27, the passage of the fuel around the guide being obtained through a plurality of holes 46.

The characteristics of the helical spring 11 (diameter of its convolutions and of the wire, number of turns, length, material and heat treatment) are, as stated above, very important inasmuch as they must be the same for all the injectors of a single engine, provided that in all injectors the distance between seats 8 and 25 against which the springs abut is maintained constant. It is preferable, as proved by experience, to use tempered steel wire for the springs because the efficiency of springs of stainless steel or phosphor bronze is reduced due to the fatigue stresses arising from the high frequency of operation and consequent vibrations.

The springs should have a low flexibility so that the thrust on the valve is light when the valve is closed (considering that the pressure of the fuel assists the valve to close) and becomes strong when the valve is open. Thus the opening begins rapidly when the force of attraction on the armature is slight due to the great air gap, the spring 11 contributing to braking the strong attraction at the end of the stroke and later facilitating the severance of the moving armature from the fixed armature, when on switching off the current the residual magnetism of the latter and its magnetic hysteresis, which always exist to a slight degree, tend to retain the armature.

In this way very quick opening and closing actions of the valve are ensured and very high frequencies of performance are possible.

Having now described my invention and how the same may be practiced, what I claim as my invention is:

1. An internal combustion engine injection apparatus of the kind recited having an elongated liquid fuel pressure chamber and an immersed valve and stem reciprocable longitudinally within the chamber with a short stroke of retraction against resilient return, in combination with electromagnetic means operable to retract and then release the valve stem, the same comprising a solenoid coil with a two-part iron core therein, one core part constituting an annular head fast on said stem and movable in the liquid therewith and of open construction for free liquid flow whereby it may shift without substantial obstruction from the liquid, the stem and head by their short stroke being adapted to leave a short magnetic gap between the two core parts in one position and to close such gap in the other position, and other iron parts constituting with said core parts a magnetic circuit disposed around said coil, said other iron parts comprising an outer housing wall, and inward extensions therefrom to the movable and the other core part respectively; said outer wall having a longitudinal extension beyond the movable core part formed with a liquid inlet, whereby a substantially stagnant space is left between said inlet and the core parts.

2. An injector as in claim 1 and wherein the

housing is shaped to provide an annular entrance chamber receiving from the liquid inlet and distributing the inflow around the circumference, and an annular passage delivering inwardly from the entrance chamber to the pressure chamber; whereby pulsating lateral pressures on the valve stem are minimized and resulting friction and wear avoided.

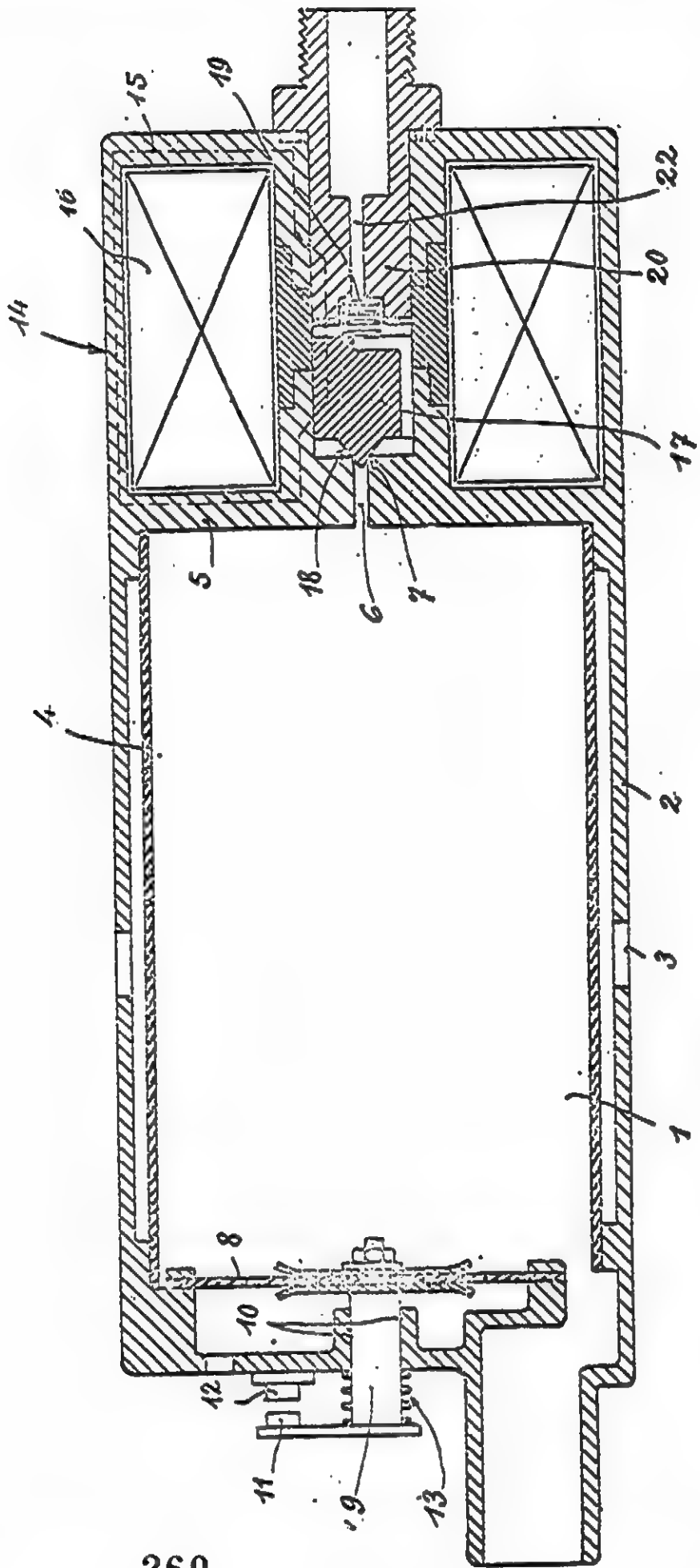
3. An internal combustion engine injection apparatus of the kind recited having a liquid fuel pressure chamber and an immersed valve stem shiftable longitudinally within the chamber with a short stroke; a spring thrusting upon the stem to advance it, and electromagnetic means operable to retract and then release the valve stem, the same comprising a solenoid coil with a two-part iron core therein, both core parts extending bodily within the coil; one core part constituting an annular head or sleeve fast on said stem and movable in the liquid therewith and of open construction for free liquid flow whereby it may shift without substantial obstruction from the liquid, and the stem and head by their short stroke being adapted to leave a short magnetic gap between the two core parts when the stem is advanced and to close such gap when in retracted position, such gap being located in the space inside the solenoid coil; and other iron parts constituting with said core parts a magnetic flux circuit disposed around said coil, said other iron parts comprising an outer housing wall, a first inward extension therefrom within and through which the movable annular core part extends and is guided, and a second inward extension between the wall and the other core part; and said stem thrusting spring being a compressed spring interposed between the two core parts thereby acting to advance the movable core part and open the magnetic gap but adapted to be overcome by the magnetic pull of the solenoid.

4. An internal combustion engine injection apparatus of the kind recited having a liquid fuel pressure chamber and an immersed valve stem shiftable longitudinally within the chamber with a short stroke, a steel spring acting on the stem

to advance it, and electromagnetic means operable to retract and then release the valve stem, the same comprising a solenoid coil with a two-part iron core therein, both parts extending into the space within the coil; one core part being longitudinally movable and comprising an annular sleeve of iron on said stem and shiftable in the liquid therewith, and of open construction for free liquid flow whereby it may shift without substantial obstruction from the liquid, the stem carrying a non-magnetic hub fast thereon and an open web between the hub and iron sleeve, and the other or fixed core part being of annular or sleeve construction at least at its end adjacent to the annular movable core part, the stem and head by their short stroke being adapted to leave a short annular magnetic gap inside the coil and between the two core parts in one position when the stem is advanced and to close such gap in the retracted position; and other iron parts constituting with said core parts a magnetic flux circuit disposed around said coil, said other iron parts comprising an outer housing wall, a first inward extension therefrom within which the movable core part or annular stem head is guided, and a second inward extension between the wall and the other core part; and said stem advancing spring being a compressed spring interposed between the two core parts acting to thrust the movable core part and open the magnetic gap but adapted to be overcome by the magnetic pull of the solenoid, said spring having its ends seated respectively on said movable core sleeve hub and within the annular fixed core part.

5. An injection apparatus as in claim 4 and wherein the movable sleeve hub is prolonged beyond the movable sleeve and beyond the core gap and protruded into the space within the fixed core sleeve, whereby the steel spring, seated on said hub and within the fixed sleeve, is located wholly inside the fixed core sleeve and removed from the magnetic gap; the spring being helical and conically tapered, with its smaller end seated on said hub.

OTTAVIO FUSCALDO.



Translation of FRENCH Patent No. 876,454, Group 5, Class 3, to Societe dite: SOCIÉTÉ DE PARIS ET DU RHONE (Société anonyme), domiciled in France (Rhône) [Albert Gachon, inventor]. Patent applied for 23 December 1940; granted 3 August 1942; published 6 November 1942.

GAS PRESSURE REGULATOR

The present invention relates to a gas pressure regulator in which:

a: the admission of gas under high pressure is controlled by means of a diaphragm actuating a contact under the effect of reduced pressure in the expansion chamber, said contact closing the circuit of an electromagnet whose movable armature when displaced automatically opens the inlet of the gas under pressure; and

b: the expansion chamber comprises a rigid body whose tightness is ensured to a large extent by means of a flexible envelope that is capable of a high degree of deformation under the effect of the internal pressure and depression, atmospheric pressure being maintained on the outer surface of the envelope, in such manner as to maintain the pressure of the expanded gas practically constant between two admissions of the gas under high pressure.

The invention also proposes by way of a novel industrial product any gas pressure regulator to which application of similar devices is made in whole or in part.

The invention will be better understood from the description which follows and from the accompanying drawing, which are given merely by way of example.

One embodiment is illustrated schematically in the drawing showing a longitudinal section.

The expansion chamber 1 comprises a rigid body 2 in which holes 3 are bored; a gastight tube 4 of very elastic or very flexible material is fitted tightly at the interior; such expansion chamber as at one of its ends 5 a gauged opening 6 forming at 7 a valve seat. At the other end there is also fitted tightly a diaphragm 8 having at its center a rod 9 guided in 10; a contact 11 fixedly connected with said rod can be brought to a position against another contact 12. A calibrated retracting spring 13 normally maintains these two contacts spaced apart; 21 [note: not correspondingly numbered in the drawing] is the duct (nozzle) for passage of the expanded gas for use. An electromagnet 14 includes a magnetic circuit 15, a coil 16 and a movable core 17 which terminates at 18 in a needle point constituting a cutoff at the part 7; a spring 19 resting against the fixed member 20 normally maintains the needle point resting on its seat. The member 20 is bored with a channel 22 and connected to the reservoir of gas under pressure. The magnet coil 16 is excited by a storage battery for example (not shown) through contacts 11,12.

The apparatus functions as follows:

When the pressure in expansion chamber 1 is adequate, the diaphragm 8 holds the contacts 11,12 apart; no current is sent through the magnet; the valve 18, urged by spring 19, cuts off the intake 6 of gas under

high pressure. As a result of the consumption of gas the flexible tube 4 is deformed and the pressure of the gas during the entire time of consumption is slightly lower than atmospheric pressure; the holes 3 permit the entry of air into the rigid body of the expansion chamber and atmospheric pressure is maintained constantly on the outer wall of the flexible tube 4. When the pressure becomes sufficiently low, the diaphragm 8 is drawn toward the interior thus bringing the contacts 11,12 nearer until they come in contact; the magnet, under the effect of the current, attracts the movable core 17, the opening 6 affords passage for the gas, and chamber 1 is filled. When the pressure is adequate, the diaphragm 8 is deformed, separates the contacts 11,12, and the current is cut off in the coil 16; the magnet no longer attracts the movable core 17 and the latter shuts off the opening 6. These operations are thus reproduced periodically.

It is evident that the invention is not limited to the single embodiment set forth above nor to its various parts, it embraces on the contrary all modifications with especial reference to the arrangement and shape of the members. For example, if preferable for mounting the apparatus on a motor, the electromagnet and the inlet of the gas under pressure could be separated from the expansion chamber by simply connecting them by means of a rubber tube bringing the gas from the gauged opening to the expansion chamber.

RÉSUMÉ

Gas pressure regulator, characterized by the following features taken separately or in combination, viz:

a: The admission of gas under high pressure is controlled by a diaphragm actuating a contact under the effect of low pressure in the expansion chamber, the said contact closing the circuit of an electromagnet whose movable armature when displaced automatically opens the inlet of the gas under pressure.

b: The expansion chamber comprises a rigid body whose tightness is ensured to a great extent by means of a flexible envelope which is capable of a high degree of deformation under the effect of the internal pressure and depression, atmospheric pressure being maintained on the outer surface of this envelope, in such manner as to maintain the pressure of the expanded gas practically constant between two admissions of the gas under high pressure.

2. By way of a novel industrial product, any gas pressure regulator as to which similar devices are applied in whole or in part.

One (1) sheet of drawings.

Translation
United States Patent Office
J.C.Levy, 8-13-58.

Fig. 1. Fig. 2.

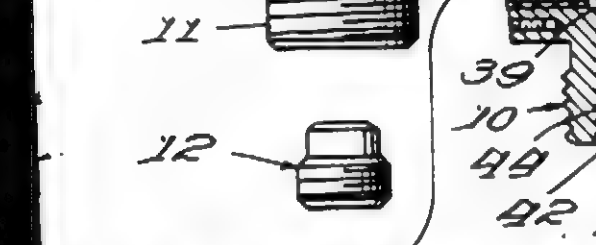
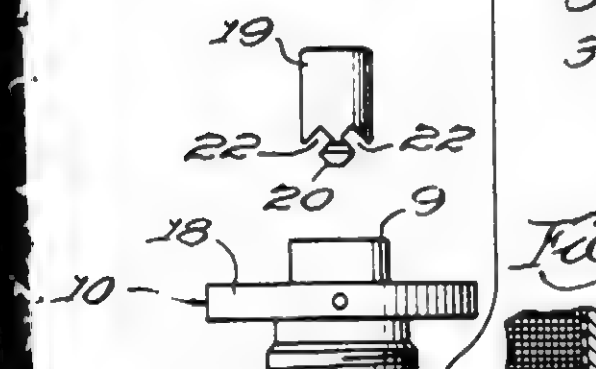
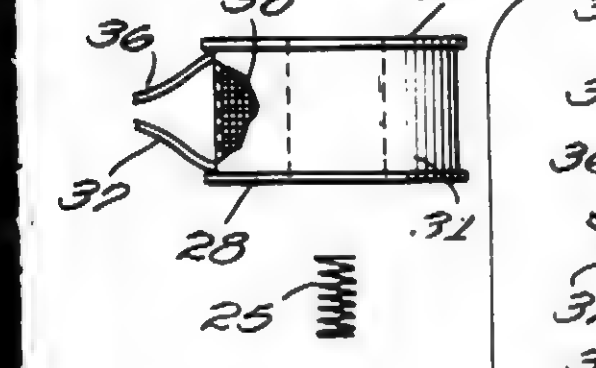
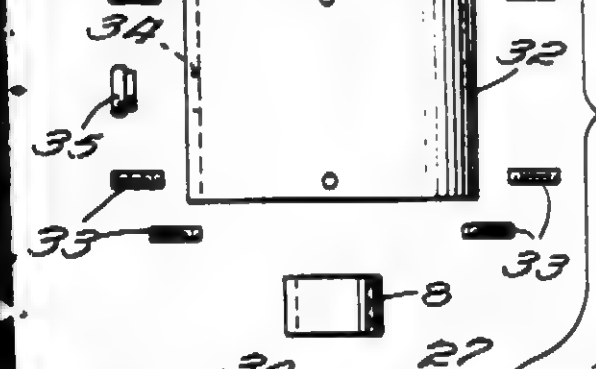
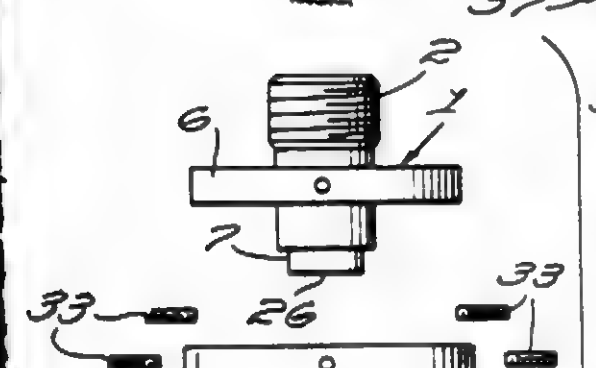
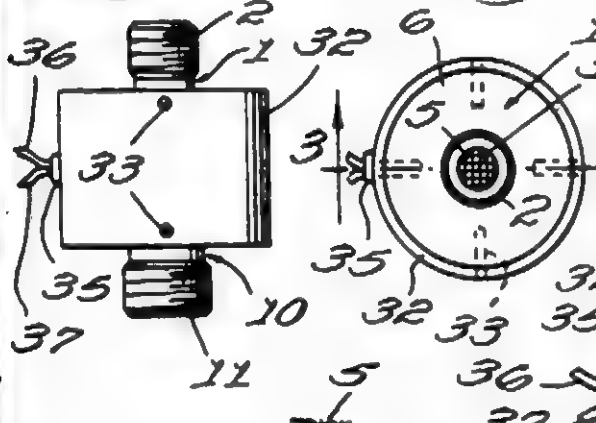


Fig. 3.

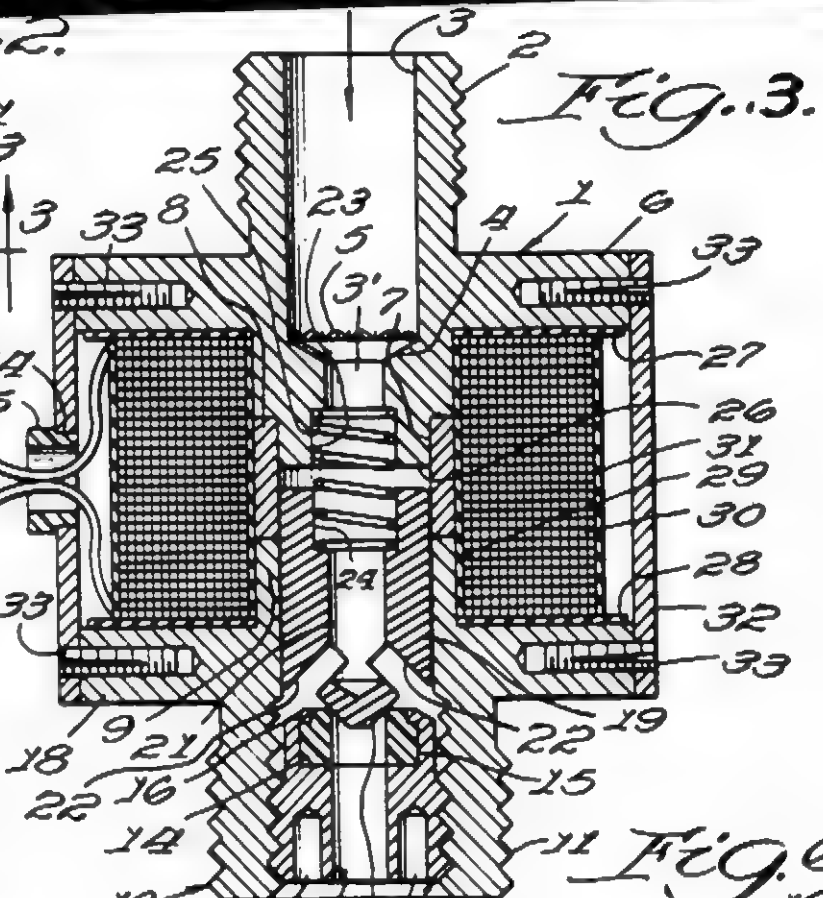


Fig. 5.

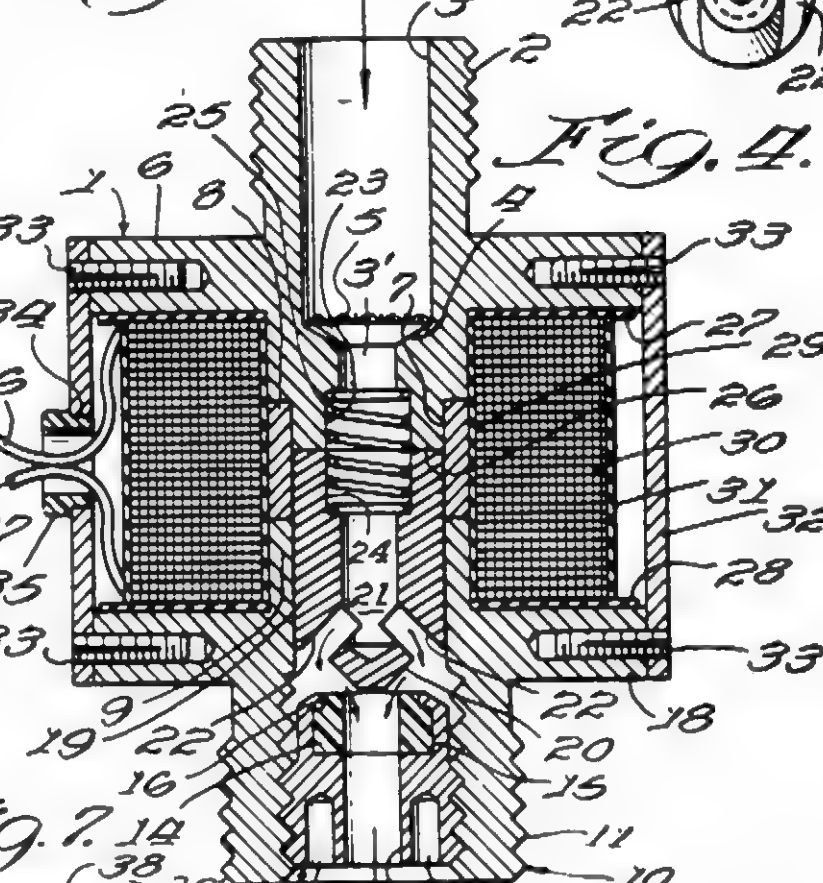


Fig. 4.

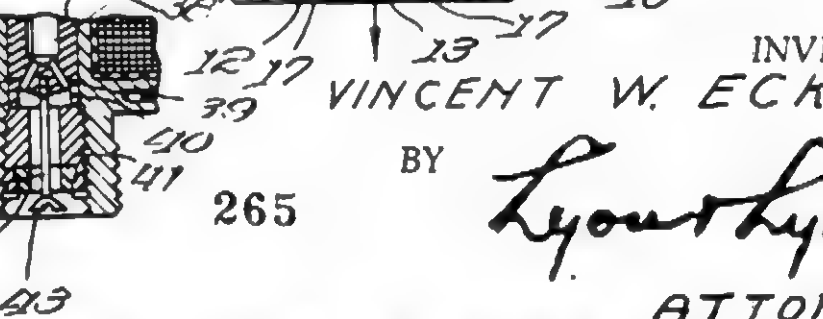
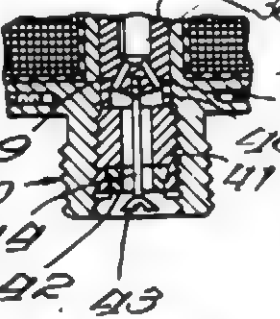


Fig. 7.



INVENTOR.
VINCENT W. ECKEL

BY *Lyon & Lyon*

ATTORNEYS

Fig. 1. Fig. 2.

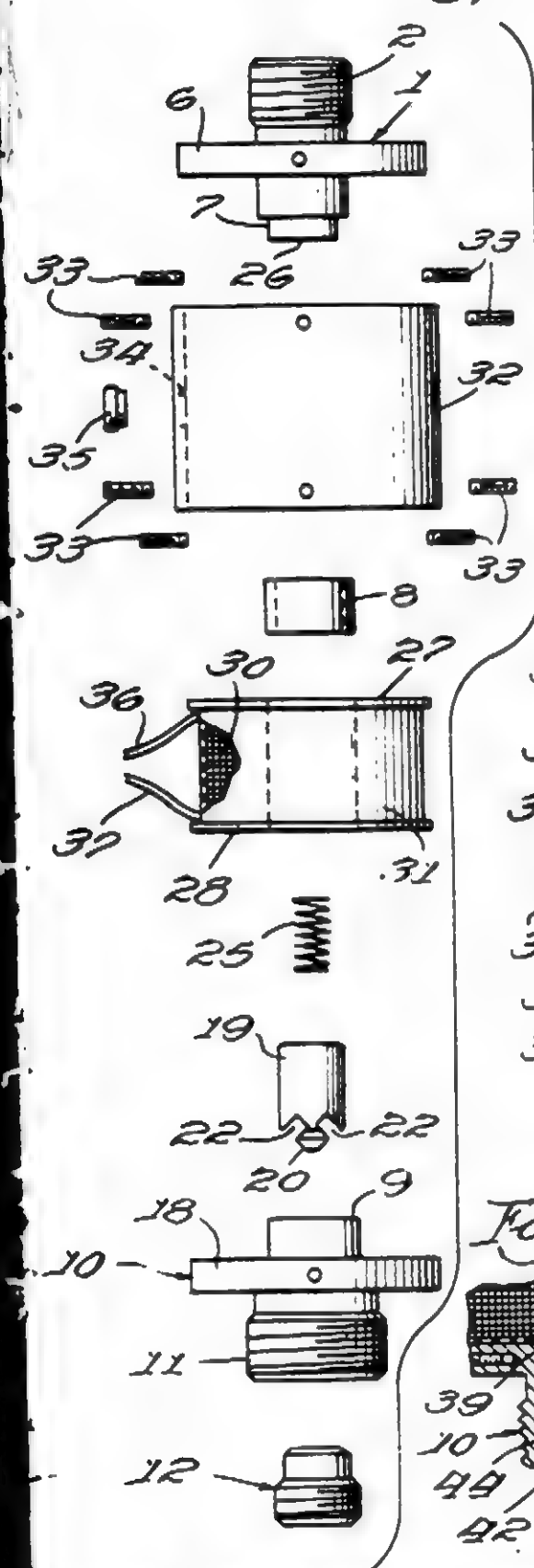
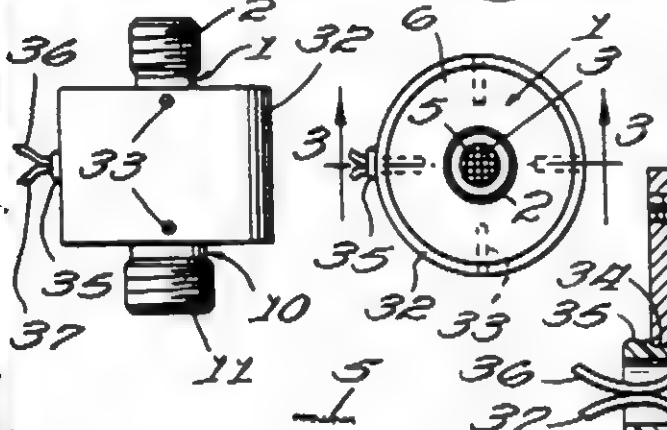


Fig. 3.

Fig. 6.

Fig. 4.

Fig. 7.

INVENTOR.

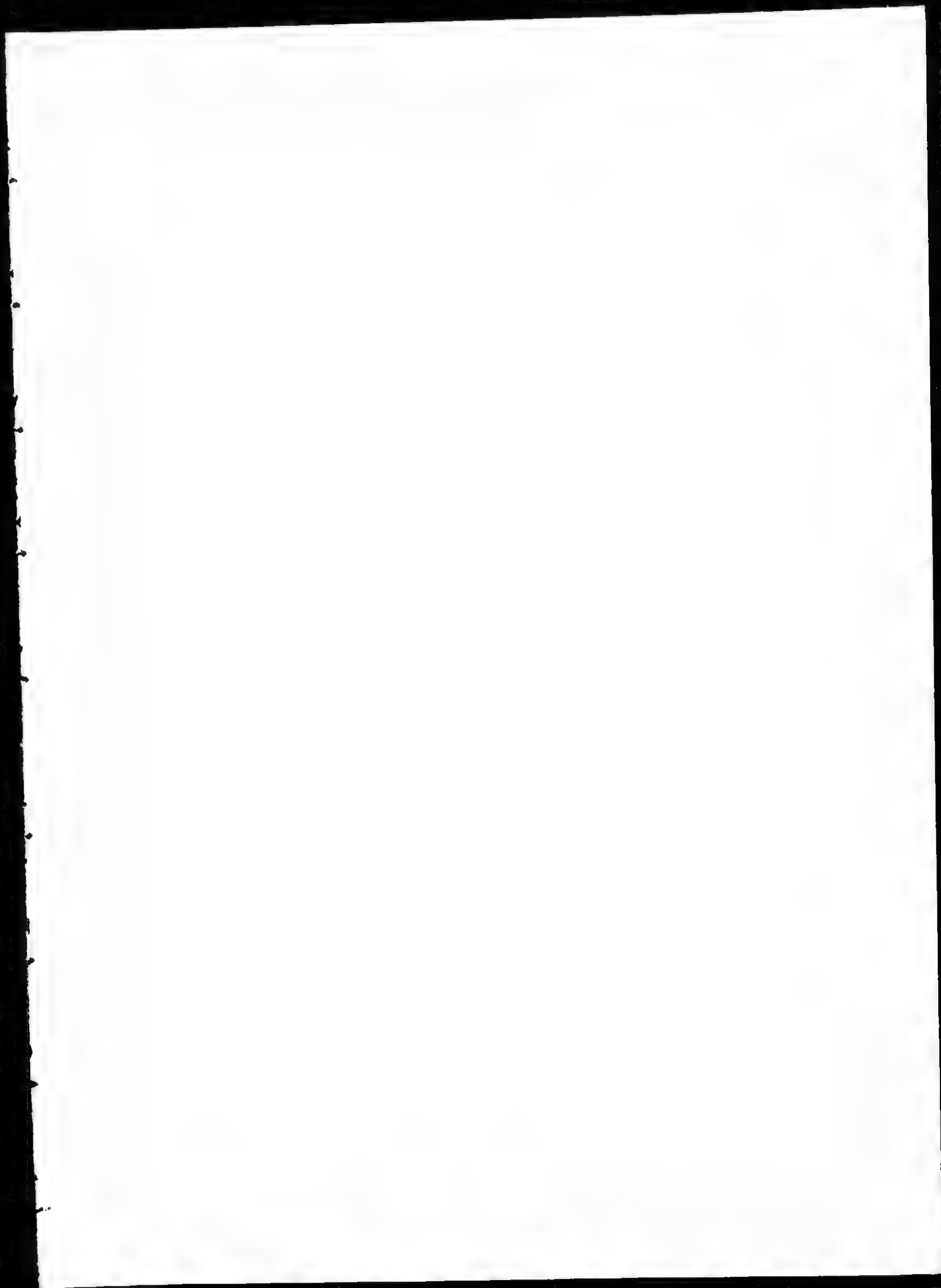
VINCENT W. ECKEL

BY

Lyon & Lyon

ATTORNEYS

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BRIEF FOR APPELLANT.

Appeal No. 19,105

**United States Court of Appeals
for the
District of Columbia Circuit**

Civil Action No. 153-63

VINCENT W. ECKEL,

Appellant,

vs.

DAVID L. LADD, Commissioner of Patents,

Appellee.

Appeal From Judgment of United States District Court
for the District of Columbia.

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Statement of Questions Presented.

Q.1. Did the District Court err in dismissing Appellant's Complaint seeking the issuance of a patent for an improved solenoid actuator and valve upon the basis that the claimed invention was unpatentable over a French patent to Gachon 876,454, which unclearly and incompletely disclosed a construction incapable of functioning as does the claimed invention?

Q.2. Did the District Court err in dismissing Appellant's Complaint seeking the issuance of a patent upon the ground that the claimed invention can "be made out of" an incomplete disclosure in a French patent to Gachon 876,454 dated approximately 15 years before the problem solved by the claimed invention arose and which admittedly does not disclose that invention?

Q.3. Did the District Court err in dismissing the Complaint against the Commissioner of Patents seeking issuance of a patent for an improved solenoid operated valve featuring:

1. a single air gap, and
2. requiring components made of materials having certain magnetic properties and which are arranged in a particular relationship;

when the basic prior art reference:

1. employs *two* air gaps operating in *opposition*, and
2. fails to disclose materials having any specific property or the importance of arranging material having different properties in any particular relationship,

and where the only prior art patent relied upon fails to cure the deficiencies of the basic reference?

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Appeal No. 19,105

United States Court of Appeals
for the
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Civil Action No. 153-63

VINCENT W. ECKEL,

Appellant,

vs.

DAVID L. LADD, Commissioner of Patents,

Appellee.

Appeal From Judgment of United States District Court
for the District of Columbia.

BRIEF FOR APPELLANT.

Jurisdictional Statement.

This Court has jurisdiction under the provisions of 28 U.S.C. 1291.

The Notice of Appeal to this Court filed under the provisions of FRCP 73 is found at JA 33.

The District Court had jurisdiction under the provisions of 35 U.S.C. 145. Appellant's Complaint is found at JA 1-7, and Appellee's Answer at JA 8-11.

In the Patent Office Appellant's application Serial No. 661,837 (JA 159-171) was filed May 27, 1957, and

was finally rejected (JA 183-184). Appellant's Notice of Appeal to the Board of Appeals (JA 189) was filed August 11, 1960. The adverse Opinion of the Board of Appeals (JA 229-232) is dated November 7, 1962, and the Opinion of the Board of Appeals on Reconsideration (JA 233-235) is dated December 17, 1962.

Statement of Case.

This Statement is divided into the following parts:

- A. The Invention.
- B. The Patent Office Prosecution.
- C. The District Court Action.

A. The Invention.

In Appellant's invention, disclosed in his application (JA 160-177, Pltf. Ex. 1-B), two magnetizable body members 1 and 10 provide spaced end flanges 6 and 18 and aligned tubular pole pieces 26 and 9 connected by a nonmagnetic sleeve 8. A current-carrying solenoid coil 30 encircles pole pieces 26 and 9 between flanges 6 and 18 and is itself enclosed by a magnetizable sleeve 32. The bore of upper pole piece 26 is smaller than that of lower pole piece 9 and sleeve 32 and a magnetizable armature 19 seats slidably in pole 9 and sleeve 8 being adapted to slide into abutting engagement with the lower end of pole 26 at the transverse center of the coil 30, the area of maximum flux strength.

Armature 19 is centrally bored, is formed with diverging ports 22 at its lower end, and is limited in its downward displacement under the urging of coil spring 25 by a nonmagnetizable annular abutment seat member 14 mounted in a counterbore 15 in a plug 12 threaded

into the lower end of the central bore through lower body member 10.

Armature 19 functions as a movable valve element. In its lower position, shown in Figure 3 in Exhibit 1-B (JA 160A, but see last page of JA for a sharper print of the drawing), its conical lower end engages nonmetallic seat member 14 thereby preventing the flow of fluid through the unit. With the coil 30 energized armature 19 is lifted, closing the single air gap normally spacing it from pole 26 and compressing spring 25. So lifted, its lower end is spaced from seat member 14 and fluid may flow through passage 3' in upper body member 1, through pole piece 26 and armature 19, and out through seat member 14 and plug 12 in lower body member 10.

The upper or inner end of armature 19 is normally closely spaced from pole piece 26 to form a *single air gap* near the transverse center of the coil 30 (JA 170, lines 1-3). Armature 19 is "circular in cross section" and its exterior surface has a close sliding fit with outlet member 10 (JA 165, lines 10-14) and with "substantially no air gap" therebetween (JA 169, lines 27-29).

The magnetizing coil 30, with one exception, is enclosed by magnetizable or magnetic members comprising body member 1 with its end flange 6 and pole 26 projecting into coil 30, body member 10 with its end flange 18 and pole 9 projecting into coil 30, and external sleeve 32 connecting flanges 6 and 18. That exception comprises interior sleeve 8 of nonmagnetizable material positioned between poles 26 and 9.

In operation spring 25 acts on armature 19 to hold its conical lower end 20 seated against nonmetallic valve

seat 14. So long as the coil 30 is de-energized, the magnetizable or paramagnetic parts are demagnetized and the valve remains firmly seated.

When coil 30 is energized the magnetic flux field created thereby magnetizes the encircling paramagnetic parts including armature 19, but is ineffective to magnetize the nonmagnetic sleeve 8 and the valve seat 14. That flux flows easily through paramagnetic materials but with relative difficulty through air and nonmagnetic parts. It magnetizes upper pole piece 26 as a "North" pole and the opposed spaced end of armature 19 with an opposite polarity, that is, "South". As a result armature 19 is drawn to pole 26 compressing spring 25 and its lower end 20 leaves its seat 14 thereby opening the valve. To be noted is the fact that the opposite ends of any magnetized member are of opposite polarities and accordingly the lower end of armature 19 is a "North" pole. It is axiomatic that poles of opposite polarity attract one another and it is therefore important that no magnetized "South" pole be positioned at the lower end of armature 19 for such a pole would oppose the attraction of the armature by pole 26 at its opposite end. The elimination of such an undesirable "South" pole at the lower end of armature 19 is accomplished by making its seat 14 of nonmagnetizable material and by separating the magnetizable parts by which the seat is carried at a distance from the armature.

It is important that Appellant's design is characterized by (1) a single working air gap between the inner end of armature 19 and fixed pole piece 26, and (2) a body or housing of paramagnetic material enclosing the coil and having inturned ends (poles 26

and 9) separated by nonmagnetizable sleeve 8. The body parts of paramagnetic material and the armature 19 form a magnetic flux loop which is closed except for the single air gap between the end of pole piece 26 and armature 19. When this single air gap is closed by movement of the armature against pole piece 26 the flux circuit is completely closed and has maximum holding power to retain the valve open.

Upon coil 30 becoming de-energized the paramagnetic materials become demagnetized and spring 25 forces armature 19 from pole 26 and its conical end 20 against its seat 14.

Appellant's construction is characterized by unusual efficiency, compactness, holding power and reliability of operation with minimum current consumption and weight. These results are obtained by providing:

1. A coil housing of paramagnetic material featuring opposed tubular pole pieces extended into the opposite ends of the flux-creating coil;
2. A sleeve of nonmagnetizable material between the spaced ends of the opposed pole pieces;
3. A one-piece armature valve of paramagnetic material having its inner end normally spaced from one pole piece by a single air gap located in the transverse center of the coil;
4. A magnetic flux circuit having only one air gap and that positioned at the center of the coil;
5. A solenoid valve in which the fluid flows centrally and longitudinally through the two longitudinally spaced pole pieces and through the armature.

B. The Patent Office Prosecution.

The Patent Office prosecution is reflected in the Joint Appendix, JA 159 to 235.

Claims 1 to 16 as amended were finally rejected by the Examiner (JA 183-184) and his position was upheld by the Patent Office Board of Appeals (JA 229-232; JA 233-235).

The Board of Appeals held all claims anticipated by Gachon's "schematic showing", taken alone or supplemented by Fuscaldo's teaching of a nonmagnetic tube 12 and a sectional main casing (JA 229; 231; 232). Other patents were held to be merely cumulative.

On Petition for Reconsideration the Board of Appeals reaffirmed its position that it would be obvious to a person of ordinary skill to use nonmagnetic material for Gachon's sleeve (the T-shaped member surrounding the right-hand end of Gachon's armature 17) (JA 234). The board further commented that Fuscaldo's tube 12, located similarly to Gachon's T-shaped sleeve, was made of nonmagnetic material (JA 235).

C. The District Court Action.

The Complaint herein (JA 1) was filed in the United States District Court for the District of Columbia seeking to have the Commissioner of Patents directed to issue Appellant a patent for the invention specified in claims 1 to 16 of his application Serial No. 661,837.

The District Court ordered Appellant's Complaint dismissed (JA 31. 32) and held:

"Only the Gachon and Fuscaldo patents were material to the issues developed at trial" (JA 28).

The Court found that Gachon failed to teach "whether either the valve casing or the annular T-shaped sleeve . . . was made of magnetizable or non-magnetizable material" (JA 29), but nevertheless concluded "plaintiff's structure is completely disclosed" in Gachon, and in addition said "the Court cannot say that plaintiff's subject matter would have been unobvious in view of Gachon and Fuscaldo to a person skilled in the art to which all of these disclosures pertain" (JA 31).

The District Court, because it failed to recognize the important physical differences, did not give weight to the critically exacting performance requirements demanded of a solenoid actuator and valve for use in spacecraft and earth-orbiting capsules. In such use it is necessary to provide high performance and reliability with minimum size and weight.

The District Court in its decision relying upon the French patent to Gachon necessarily made a great deal more "out of" that patent than was disclosed or even suggested therein. In so doing it erred.

Statutes.

It is contended that Appellant is entitled to a patent under the following statutory provisions:

"The Congress shall have Power * * * To promote the Progress of Science and useful Arts, by securing for limited Times to Authors and Inventors the exclusive Right to their respective Writings and Discoveries;"

U. S. Constitution, Article I, Section 8.

"Whoever invents or discovers any new and useful . . . machine . . . or any new and useful im-

provement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.”

35 U.S.C. 101.

“A person shall be entitled to a patent unless —

- (a) the invention was known or used by others in this country . . . or
- (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of the application for patent in the United States, or . . .”

35 U.S.C. 102.

“A patent may not be obtained though the invention is not identically disclosed or described as set forth in Section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains . . .”

35 U.S.C. 103.

The District Court dismissed Appellant’s Complaint relying in part on 35 U.S.C. 102(b) and in part on 35 U.S.C. 103. The District Court apparently had Section 102(b) in mind when it said:

“With the above interpretation of the Gachon patent, it appears to the Court that the plaintiff’s structure is completely disclosed” (JA 31, lines 3-5);

and Section 103 in mind when it said:

"Manifestly, the Court cannot say that plaintiff's subject matter would have been unobvious in view of Gachon and Fuscaldo to a person skilled in the art to which all of these disclosures pertain" (JA 31, lines 5-8).

Statement of Points.

The points upon which Appellant intends to rely are as follows:

1. The District Court erred in holding that Appellant's invention disclosed and claimed in Application Serial No. 661,837 is unpatentable in view of the French patent to Gachon 876,454.
2. The District Court erred in holding that Appellant's invention disclosed and claimed in Application Serial No. 661,837 is unpatentable in view of the patent to Fuscaldo 2,297,399.
3. The District Court erred in holding that Appellant's invention disclosed and claimed in Application Serial No. 661,837 is unpatentable in view of the combined teachings of the patents to Gachon 876,454 and Fuscaldo 2,297,399.
4. The District Court erred in finding Gachon's vague and incomplete teachings to be adequate to enable a person of ordinary skill in the art to make Appellant's magnetic actuator capable of meeting the exacting requirements of spacecraft.
5. The District Court erred in finding Gachon, French 876,454, to be adequate to teach one of ordinary skill in the art how to build the high efficiency magnetic actuator of the claimed in-

vention using different specific materials in precise relationship to one another and in so doing ignoring the fact that Gachon fails to specify any of the properties of or particular materials in his magnetic actuator.

6. The District Court erred in holding that Gachon's casing was of magnetic material based upon an alleged "demonstration" by the Patent Office (which was not made) of the location of Gachon's magnetic circuit.
7. The District Court erred in holding that "magnetic circuits usually are assumed to pass through magnetic materials" but not through nonmagnetic materials.
8. The District Court erred in holding that the use of magnetic material for Gachon's valve casing would provide a satisfactory valve contrary to the only evidence which was to the effect that Gachon's valve seat would unavoidably form a second magnetic pole opposing the working magnetic pole and his unit would be "quite inefficient".
9. The District Court erred in holding that the Patent Office had a sound basis for assuming that Gachon teaches the use of magnetic material for his valve casing merely because Gachon described his magnetic circuit as passing along the valve casing in view of the uncontradicted

expert testimony to the effect that magnetic flux passes through both magnetic and nonmagnetic materials.

10. The District Court erred in refusing to accept the uncontradicted expert testimony that good engineering practice in constructing the Gachon valve would make use of nonmagnetic material for the valve casing in view of the fact that if Gachon were to use magnetic material he would have a valve seat acting as a magnet opposing the opening of his valve.
11. The District Court erred in holding Appellant's invention to be obvious in view of the uncontradicted testimony that his actuator provided a highly reliable, lightweight valve for spacecraft which was only $1/5$ to $1/4$ as heavy as other available valves.
12. The District Court erred in holding that Gachon's undescribed T-shaped sleeve "was made of non-magnetizable material."
13. The District Court erred in holding that Gachon's valve, assuming its casing was made of magnetic material and the unit was operable, would anticipate Appellant's invention.
14. The District Court erred in holding that the invention set forth in Appellant's claims 1 to 16, and each of them, is obvious to a person of ordinary skill in the art and therefore lacking in patentable novelty under the Patent Statutes.

Summary of Argument.

Appellant's argument that the decision of the District Court was error is presented as follows:

A. *Gachon's Disclosure Is Inadequate:*

1. It is a foreign French patent relating to a "gas pressure regulator," illustrated "schematically", with a complete absence of each and every detail which makes Appellant's solenoid actuated valve the compact, lightweight, highly efficient unit justifying its use in each and every manned space flight of the United States to date.
2. It is not ascertainable from Gachon's disclosure whether his parts are magnetic or nonmagnetic. If magnetic his construction provides two air gaps and two sets of poles, the sets working in opposition to each other to render his construction ineffective.
3. It is not ascertainable from Gachon's disclosure whether his parts are nonmagnetic but if nonmagnetic, his construction is inefficient and therefore incapable of high effectiveness with light weight as in Appellant's unit.

B. *Fuscaldo Does Not Teach the Invention Nor Does He Adequately Supplement Gachon.*

1. Fuscaldo does not teach Appellant's construction.
2. Fuscaldo does not make it obvious to provide Gachon with a short nonmagnetic sleeve positioned centrally of the coil between the ends of poles extending into the solenoid coil, as in Appellant's device, but instead teaches a nonmag-

netic tube 12 extending the entire length of the coil between one pole located outside the coil and a second pole nearly as long as the coil itself.

3. Fuscaldo does not make it obvious to provide Gachon with an air gap at the center of his coil where the flux strength is maximum for he places his air gap near one end of his coil.

C. Appellant Failed to Make the District Court Understand.

1. The District Court misinterpreted the uncontradicted evidence and found in error:

"It was generally admitted at trial that the components of the Gachon device and the manner in which they were assembled was highly similar to the subject matter plaintiff claimed as his invention." (JA 29, lines 15-18).

2. The District Court in error found that the Patent Office had made "a demonstration" respecting the location of Gachon's magnetic circuit.

D. Appellant's Invention Was Not Obvious in View of the Prior Art.

The District Court relied upon the Gachon French patent primarily and referred also to Fuscaldo 2,297,399 which has the shortcomings set forth above at A and B, to teach Appellant's invention comprising a unit doing a job previously requiring units weighing four or five times as much, an invention which has found multiple uses in each and every United States manned spacecraft.

E. *The Law*

1. The right to a patent for a novel invention is not to be denied upon the basis of an incomplete, inadequate disclosure not disclosing the invention nor even a recognition of the problem the invention solves.
2. An incomplete, inadequate disclosure of a foreign patent may not be supplemented to "make out of it" more than it teaches.

ARGUMENT.

This Argument is divided into the following parts:

- A. Gachon's Disclosure is Inadequate.
- B. Fuscaldo Does Not Teach the Invention Nor Does He Adequately Supplement Gachon.
- C. Appellant Failed to Make the District Court Understand.
- D. Appellant's Invention Was Not Obvious In View of the Prior Art.
- E. The Law.

A. Gachon's Disclosure Is Inadequate.

Gachon is a French patent directed to a gas pressure regulator. The single sheet of drawing is found at JA 260 and the English translation is reproduced at JA 261-264. Appellant's Exhibit 8 (JA 241) is an enlargement of the magnetic valve portion of Gachon's regulator. Gachon's specification concedes his device is "illustrated schematically" (JA 262, lines 1, 2).

Gachon discloses "a gas pressure regulator" wherein "gas under high pressure is controlled by means of a diaphragm actuating a contact . . . closing the circuit

of an electro-magnet . . . (which) automatically opens the inlet of the gas under pressure;" (JA 261, lines 11-17). Gachon was not particularly interested in his magnetic actuator. Any electrically operated valve could have served the purpose in his "regulator". His lack of interest is evidenced by the superficial undetailed description in his specification and his "schematic" drawing.

Gachon's description of his electromagnet valve and its operation occupies only 13 lines and reads as follows:

"An electromagnet 14 includes a magnetic circuit 15, a coil 16 and a movable core 17 which terminates at 18 in a needle point constituting a cut-off at the part 7; a spring 19 resting against the fixed member 20 normally maintains the needle point resting on its seat. The member 20 is bored with a channel 22 and connected to the reservoir of gas under pressure. The magnet coil 16 is excited by a storage battery for example (not shown) through contacts 11, 12.

* * *

". . . the magnet, under the effect of the current, attracts the movable core 17, . . . the current is cut off in the coil 16; the magnet no longer attracts the movable core 17 and the latter shuts off the opening 6. These operations are thus reproduced periodically." (JA 262, lines 15-24; JA 263, lines 10-18).

Appellant's invention, a solenoid valve, in one embodiment weighing only 1-7/8 ounces, replaced a competitive valve weighing 10 ounces (JA 139, lines 21-

30). The importance of this was evidenced by the fact that aircraft manufacturers view the saving of even one ounce of weight as being very important (JA 139, lines 31-34).

Appellant's lightweight valve was highly efficient because of its design, flux pattern, the presence of only a single air gap and a single pair of poles centrally of the coil, and use of particular materials in the flux circuit (JA 160-169, incl.).

Unless the representation just made is error, and the trial court record contains not one suggestion that it was contested, then clearly a patent disclosure, which does not teach those features or factors, cannot teach the distinctions which enable Appellant's 1-7/8 ounce valve to perform the job of a 10 ounce valve of the prior art.

Appellant's unit comprises a magnetic circuit formed by paramagnetic or magnetizable elements surrounding the coil 30. The Gachon French patent says not one word about the characteristics, the material, or magnetic properties of his body 2 except that it is "rigid" (JA 262, line 3).

In Appellant's unit the magnetic circuit has a magnetic pole 26 opposite only one end of his movable armature 19. In the Gachon French patent his body 2 is described only as "rigid" and the material at each end of the Gachon armature 17 is the same material. That material is either magnetic (magnetizable) or nonmagnetic (nonmagnetizable). If the former there are pairs of poles at each end of armature 17, one working against the other, when the armature 17 is moved magnetically — clearly not the way to increase the magnetic efficiency of the Gachon flux circuit.

Appellant's air gap between his upper pole 26 and the armature 19 is positioned at the center of the coil 30, the point of greatest flux strength, and there is no air gap between the other (lower or outer) end of armature 19 and any magnetizable pole or element. In Gachon's French patent the lower end of armature 17 ends within the coil 16 and seats against the opposed stop member of the same material as body 2. Immediately that current flows in coil 30, both sets of poles are magnetized, and the lower set, being in contact, are relatively strong as compared to the inner set which are separated by an air gap. Closing of this air gap can occur because of the greater flow strength centrally of the coil, but is opposed by the outer set of poles (JA 81, lines 1-15; JA 99, lines 19-33).

Appellant's unit includes a magnetizable casing enclosing the coil 30 the opposed ends of which, within the coil, are bridged (spaced) by a nonmagnetizable sleeve. Gachon's French patent does not specify nor suggest a nonmagnetizable sleeve.

Gachon's description does not mention important critical details such as:

1. Material used for any component;
2. Whether any part is nonmagnetic;
3. Whether any part is paramagnetic;
4. Whether some parts are nonmagnetic and others paramagnetic and how disposed relative to one another;
5. The fact that if Gachon's member 5 and core 17 are magnetic, as the Court below held, energization of coil 16 necessarily magnetizes all of member 5 and all of core 17 and they are

drawn together. In consequence of such attraction the magnetizing effect across Gachon's inner working air gap and the net force effective to displace the armature to open the valve and displace it from member 5 would be reduced.

The presence in Gachon of a second pair of pole pieces at the outer end of core 17 and the presence therebetween of a second air gap — both unavoidably operating in direct opposition to the pole pieces and air gap centrally of Gachon — leads one directly away from the solution found by Appellant. This is equally true of the identical cross-hatching lines of Gachon's core 17 and T-shaped sleeve indicating that they are made of the *same* material rather than of materials having different magnetic properties, as they must possess to operate effectively as in Appellant's device and with minimum power consumption.

Dr. Frank E. Mauritz, Appellant's expert, is a graduate of Johns Hopkins University with the degree of Doctor of Engineering. He has engaged in patent work — particularly in the electrical field where he has "handled at least one-hundred patent applications in valves alone" (JA 65, lines 15-18).

Dr. Mauritz was asked whether it would be obvious to one skilled in the art to build Appellant's device from the Gachon teachings (JA 80, lines 1-5). He criticized Gachon's disclosure for its

"... nebulousness and indefiniteness, and particularly its failure to recite particular materials; and particularly whether a material is magnetic or nonmagnetic. By that I mean magnetizable or nonmagnetizable. In fact, he does not indicate any

of his materials as being in either one of those categories. So it is entirely in one's imagination as to what material it actually is, that is whether it is magnetizable or nonmagnetizable." (JA 80, lines 6-16).

Dr. Mauritz referred to Appellant's Exhibit 8 and testified that, if Gachon's casing were of magnetic material, and Gachon doesn't say, there would be two sets of opposing poles and two air gaps, each operating in *opposition* to one another at opposite ends of armature 19. At JA 90 he pointed out that member 20 at the right hand end of coil 16 would be "a north pole" and the spaced adjacent inner end of armature 17 would be a "south pole". Also at the other end of armature 17 would be a "north pole", and the seat portion 7 of valve casing 5 would be a "south pole." Dr. Mauritz summarized his description, saying:

"Now, we see the overall pattern. We have a north pole — south pole, a north pole and a south pole. Now we all know that a north pole attracts a south pole." (JA 90, lines 21-22).

When the poles of one of the pair are in contact a flux air gap exists between the other pair; and vice versa. The uncontradicted testimony is to the effect that Gachon necessarily has working air gaps at the opposite ends of his armature 17 if it be assumed, and he doesn't say, that his casing is of magnetizable material.

Dr. Mauritz made clear the result of having two pairs of pole pieces each with its own air gap and acting in opposition to the other and as follows:

". . . My testimony was that the development of these lower poles, these lower north and south

poles in plaintiff's exhibit 8 causes a force to be developed which is in opposition to this useful force which you are trying to develop from the coil. So with Gachon's construction and with the assumption that the element 5 is of magnetic material you would be defeating your purpose. I wouldn't go so far as to say it would be inoperative but it would be quite inefficient. In my opinion, a designer for one responsible for manufacturing these solenoids of this type would not use magnetic material here and develop this extra north and south pole which would be operating in a direction to defeat his purpose.

"The Court: Well, there would be one opposing the other equal in strength and opposite in direction, is that it?

"The Witness: Well, because of the areas here I wouldn't say it would be equal and opposite, but there would be definite force.

"The Court: One opposing the other? Two forces one opposing the other?

"The Witness: That is correct, sir.

"The Court: All right." (JA 99, line 16, to JA 100, line 10).

It is therefore clear that if Gachon's casing 2, defined only as "rigid", be assumed to be of magnetic or magnetizable material, he has provided an undesirable device, one which instead of weighing 1-7/8 ounces and having capabilities comparable to a competitor's valve weighing 10 ounces, would instead, because of its ineffectiveness, weigh more than the competitor's device.

The fact is the Gachon French patent does not state what material is used in his "rigid" body 2. He gives no indication whether it is magnetic (magnetizable or paramagnetic) or nonmagnetic (nonmagnetizable). The presence of the dotted line in the Gachon drawing gives no indication for Dr. Mauritz testified flux passes through both magnetic and nonmagnetic material. The record contains the following excerpts:

"Q. . . . Will a dotted line showing a magnetic line of force tell you the nature of the material?
A. No, sir." (JA 91, lines 19-22).

"Q. We are talking about a patent disclosure which shows a line that indicates a magnetic circuit. A. Even though it has a line which purports to show a line where flux may flow. I know flux will flow through a vacuum, it will flow through air, it will flow through copper and magnetizable material. That in itself doesn't give me any information as to the nature of the material, because the same flux can flow through all these various materials." (JA 105, lines 20-28).

"A. . . . A line designating a magnetic circuit as such and nothing more does not identify the material, because a magnetism can flow through air. As a matter of fact, it can flow through a vacuum. It can flow through magnetizable and nonmagnetizable material. Just the fact that you have drawn a line indicating a magnetic circuit is no indication at all as to what the material is." (JA 103, line 29, to JA 104, line 3).

Nor does Gachon anticipate Appellant's invention if it is assumed that his coil housing described only as a "rigid body" (JA 262, line 3) is made of "nonmag-

netic" material as Dr. Mauritz stated seemed preferable to him because "... it would be contrary to good engineering practice to make it of magnetizable material." (JA 88, lines 31-33). Dr. Mauritz's explanation of this answer has been reviewed above and involves the presence of two air gaps and the two pairs of pole pieces with the pairs working in opposition to one another.

Dr. Mauritz was of the view Gachon's device would operate with only his plunger 17 made of magnetic material saying:

"... the only element that need be magnetizable is his plunger 17; and it is possible to operate the Gachon system with the other elements being of nonmagnetic material; all of them or some of them." (JA 80, lines 18-22).

However, Appellant's invention involves not mere operability but highly superior results with light weight. It depends upon using a magnetizable coil housing having inturned ends terminating in pole pieces within the coil upon opposite sides of a single centrally disposed air gap. Appellant's claims expressly define these features thereby precluding anticipation by Gachon's coil housing if made of nonmagnetizable material and therefore incapable of magnetically attracting and holding plunger 17 in its actuated or open position. These express limitations are distinctly set forth in Appellant's claims.

All claims specify that Appellant's coil housing be either a "magnetizable structure" or the equivalent "paramagnetic material" (JA 171-7, claims 1-16). The "non-magnetic" material assumed as used for Gachon's

housing, by definition, lacks magnetic properties and is not magnetizable.

Certain claims specify that this "magnetizable structure" has a pair of pole pieces within the coil. Claim 5, for example, calls for "a magnetizable structure . . . including a pair of pole pieces . . . spaced to effectively define an air gap centrally located within the confines of said coil." (JA 172, lines 6-10).

Claims 1, 6 to 16 also specify that the magnetizable coil housing has one or more pole pieces.

Certain claims, see claims 7 to 11, specify that the "paramagnetic" mounting element or coil body include a "sleeve" or "tubular section" of "nonmagnetic material", reference being had to Appellant's sleeve 8 colored yellow in Exhibit 20 which bridges the pole pieces (JA 172-176).

All of appellant's claims contain express limitations which cannot be read on Gachon if his rigid body 2 is made of nonmagnetizable material. This is another way of saying that Appellant's claims do not call for the structure of Gachon if the latter is made of nonmagnetizable material. Of course, without a magnetizable coil housing Gachon would not efficiently use the flux created by this coil when energized and he would have no fixed pole piece to attract and hold his plunger 17 in an actuated position.

If it be contended that Gachon contemplated making his fluid inlet member 20 of "magnetizable" material, and that that member is the "magnet" mentioned by Gachon in describing the operation of his valve, the value of Gachon as prior art is not improved. Each claim fails to read on Gachon's structure so construed. For

example, member 20 does not provide "spaced pole pieces . . . each within and defining an air gap centrally . . . of the coil" as required by claim 1 (JA 171, lines 3-5); nor a "magnetizable flux path structure partially encircling said coil" and "with the open ends thereof both extending into opposite ends of said coil" as required by claim 2 (JA 171, lines 16-18). Each of the remaining claims contains the similar limitations which do not read on Gachon if his member 20 is viewed as the "magnet" referred to by him in describing the operation of his device.

B. Fuscaldo Does Not Teach the Invention nor Does He Adequately Supplement Gachon.

The Patent Office and also the District Court relied upon Fuscaldo only to supplement Gachon. Both relied upon Fuscaldo for his showing of a nonmagnetic tube 12.

The District Court said:

" . . . Fuscaldo clearly shows his tube 12 in a position similar to that of Gachon and states that it is nonmagnetic." (JA 232, lines 10-12).

Appellant contends that Fuscaldo, rather than teaching one how to cure any shortcoming in Gachon, actually leads one in the wrong direction and away from Appellant's invention. Fuscaldo took the wrong path at least three times as hereinafter explained.

Firstly, Fuscaldo teaches a nonmagnetic tube 12 extending within his coil 30 for the full length of the coil (Deft. Ex. 1A, Fig. 1b). This was stated by Dr. Mauritz as being in accordance with long-standing "conventional" practice (JA 97, lines 27-33). Appellant re-

stricts the tube to the space between the inturned ends 26 and 9 of the coil housing (Pltf. Ex. 20) and found this to provide superior results.

Secondly, Fuscaldo teaches (Deft. Ex. 1A, Fig. 1b) the positioning of the inner end of his armature 5 and the working air gap 7 adjacent thereto at one end of his nonmagnetic tube 12 and near one end of his coil 30 rather than at the transverse center of the coil as taught by Appellant (Pltf. Ex. 20) and found by him to be important to efficient operation.

Thirdly, Fuscaldo locates his valve 10 (JA 255, Fig. 1a) at a distance from his coil 30 and connected to his armature 5 and its bronze hub 8 by a long rod 9 surrounded by a flow conducting extension tube 27. He thereby introduces additional size, weight, tolerance, and alignment problems, and the likelihood of the armature "binding". In Appellant's solution, the armature itself acts as the valve; Fuscaldo's elements 8, 9, 10 and housing extension 27 are entirely absent with their weight and space requirement. In Appellant's design the Fuscaldo alingment, tolerance and "binding" problems are likewise eliminated.

As contrasted with that teaching, in Appellant's device the fluid flows through the armature 19 and out the end thereof (Pltf. Ex. 20).

Gachon fails to teach Appellant's construction concept of a magnetizable casing having end poles extended into the magnetizing coil which poles are separated by a nonmagnetizable sleeve. Does Fuscaldo supply that shortcoming? The answer is No. Fuscaldo does not have two poles extended into his coil from its opposite ends and spaced by a nonmagnetizable sleeve. Fuscaldo's sleeve 12 extends the full length of his coil.

Gachon fails to teach a single air gap positioned at the center of his coil, the point of maximum flux strength. Does Fuscaldo supply that deficiency? The answer is No. Fuscaldo's air gap is not at the center of his coil.

Gachon fails to teach the concept of a lightweight, highly efficient solenoid actuator or even the recognition of the desirability of such a construction. Does Fuscaldo provide that deficiency? The answer is No. Fuscaldo's fuel injector for engines weighs pounds, not ounces, and contains no suggestion of a featherweight construction.

C. Appellant Failed to Make the District Court Understand.

Appellant's structure depends for its efficiency upon the presence of a casing of magnetizable or magnetic material surrounding the coil except for a centrally located sleeve 8 within the coil of nonmagnetic or non-magnetizable material.

The record contains no contradiction of that contention.

The District Court in error said:

"It was generally admitted at trial that the components of the Gachon device and the manner in which they were assembled was highly similar to the subject matter plaintiff claimed as his invention." (Opinion, JA 29, lines 15-18).

On the contrary, the record contains the following:

"Mr. Kendrick: . . . They do not contend the reference shows the device called for by the claims. "The Court: Why of course not." (JA 79, lines 18-20).

The expert Mauritz said:

"... I find it very difficult to apply the language of the subject matter here to the Gachon disclosure because of its nebulousness and indefiniteness, . . ." (JA 80, lines 7-9).

It was not clear how many air gaps the French Gachon patent had and we find the following:

"Q. Now, does the Gachon patent disclose a single air gap as called for by claim 7 in Eckel's application? A. There again, the very nature of this disclosure, which is very sketchy to say the least, we can't say truthfully . . ." (JA 80, lines 23-27).

"Q. Based on all your experience of studying patents and your work in getting your doctorate at Johns Hopkins . . . could you state that it would be obvious to one skilled in the art to make the several modifications that need be made to make the combination of elements called for by claim 7 of the patent? A. It certainly would not be obvious to me that someone could just take this disclosure and come up and produce the Eckel valve with all of its beneficial results." (JA 81, line 30, to JA 82, line 6).

"Q. Would you tell the Court whether or not there is any teaching in Gachon of making the casing member that has been colored red of a magnetizable material as called for by the claims in the application that are in issue before this Court? A. There is no teaching that such casing should be" (JA 85, lines 20-25).

"A. That is true. In exhibit 20 these elements here are all of magnetizable material. The French

patent, Gachon patent, doesn't mention which materials are magnetic or nonmagnetic.

The Court: Are the materials themselves mentioned?

The Witness: I beg your pardon, sir.

The Court: Are the materials themselves?

The Witness: No, sir.

The Court: They are not?

The Witness: No, sir." (JA 87, line 30, to JA 88, line 6).

"The Court: That is the casing of the coil (Gachon's), isn't it?

The Witness: Yes, sir.

The Court: You say it is nonmagnetic, or you don't know?

The Witness: I would say it would be contrary to good engineering practice to make it of magnetizable material.

The Court: How about in your own device, isn't that magnetizable?

The Witness: Well, there is a different structure here, sir.

The Court: I see." (Parenthetical matter inserted, JA 88, line 28, to JA 89, line 5).

"Q. Now does the Fuscaldo reference teach the use of a short nonmagnetic sleeve as called for in the claims of the Eckel application and as exemplified on plaintiff's exhibit 20? A. On the contrary, Fuscaldo definitely teaches a long sleeve extending the full length of the coil." (JA 97, lines 22-27).

Clearly the District Court lost sight of all the differences and uncertainties present when it made the statement first quoted in this title.

The District Court erred (1) in finding that the Patent Office had made a "demonstration" respecting Gachon's magnetic circuit and (2) in relying upon that alleged "demonstration" as rebutting the testimony of Appellant's expert Mauritz. No "demonstration" was made to the District Court by either party. The Court's statement to the contrary must be based on a misunderstanding. The fact is that the Patent Office produced no witnesses and only cross-examined Appellant's witnesses.

Therefore to hold, as the Court did, that Appellant's position respecting Gachon "was effectively rebutted by the Patent Office's demonstration" respecting Gachon's "magnetic circuit", and that this demonstration "proved to the Court's satisfaction . . . that the Patent Office had a sound basis" for holding as it did ". . . the Gachon device was operable with a magnetizable casing" (JA 30, lines 10-23) cannot be understood.

Appellant did not contend Gachon would not operate if his casing was all magnetizable material as the District Court apparently believed. Appellant's witness Dr. Mauritz testified:

"I wouldn't go so far as to say it would be inoperative but it would be quite inefficient." (JA 99, lines 26-28).

Appellant's invention is a light, featherweight, solenoid actuated valve. If it is magnetically inefficient it cannot be light. That was Appellant's contention. Not that Gachon was inoperative but instead inefficient and therefore incapable of accomplishing Appellant's concept and purpose.

One would not equate a truck to a racing car. The Gachon device should not be equated to Appellant's device. Appellant failed to make this clear to the District Court.

D. Appellant's Invention Was Not Obvious In View of the Prior Art.

The District Court found "Only the Gachon and Fuscaldo patents were material to the issues developed at trial" (JA 28, lines 15-17).

The principal reference, Gachon, is characterized by the absence of any teaching of the features crucial to the success of appellant's invention. Gachon devotes 13 line of disclosure, devoid of detail, to his construction relevant to Appellant's invention.

Fuscaldo, in contrast, and in 900 lines of disclosure, emphasizes factors which must be present and others to be avoided.

Appellant's problem was not the provision of a magnetic valve which would operate. Valves which would operate were old. He required a valve operating with maximum efficiency and unfailing reliability, of maximum compactness and minimum weight; a valve having maximum armature closing power, one which could meet the exacting requirements of spacecraft applications.

The evidence before the Court was that aircraft companies could afford to spend \$200 for each pound of weight saved (JA 139, lines 29-33), and that the importance of weight savings in missile and spacecraft applications was many times greater (JA 137, lines 17-22).

James L. McCoy, Chief of the Instrument Section at the government aircraft test laboratories at Wright Field during World War II (JA 125, lines 9-11; 126, lines 2-7) testified that the "major problem" in connection with aircraft valves "always is weight, to try to reduce weight of the components, because any weight that may be cut off without reducing the performance of the part then becomes available as useful payload to the aircraft" (JA 126, lines 11-16). Mr. McCoy was shown Appellant's Exhibits 2 and 4 valves and stated that the weight saving over competitive valves with which he was familiar was "a factor of at least four or five times", and "In some cases more than that"; and that "a 2-ounce Eckel Valve would do the work of an 8-ounce T-shaped valve" (JA 130, lines 1-21) available from Appellant's competitors.

Mr. McCoy made a market survey for Appellant to see if "engineering people in corporations such as North American, Douglas, Chance Vaught, McDonnell . . . were as favorably impressed with it (Ex. 2 and 4 valves) as I was; and the reaction was enthusiastic" (JA 128, line 30, to JA 129, line 21). In this survey, he called on Lockheed, Douglas, North American, Northrup, Consolidated, Boeing, Martin, Chance Vaught, and, answering the Court's query as to the reaction of engineers contacted in this survey, said, "There was a uniform enthusiasm, Your Honor" (JA 130, line 22, to JA 131, line 11); and that aircraft engineers at these companies "felt that this had met the need they had for a long time for a light-weight, high performance valve" (JA 131, lines 13-17). The Exhibit 2 and 4 valves "weighed 1 and 7/8 ounces each" (JA 139, lines 16-23) of which 55,000 were sold to one customer in 13 years (JA 140, lines 25-34).

A smaller version of Appellant's valve weighing only "7/8 of one ounce," Exhibit 5-A (JA 142, lines 1-4), was a component on the United States Titan II missile fired successfully two days before the testimony before the District Court (JA 142, lines 24-33).

Appellant's Exhibit 3-A valve weighing "1 and 7/8 ounces" (JA 143, lines 1-29) has been a successful component in numerous space capsules including Gemini, Mercury, Surveyor, Skybolt, Roadrunner and Redhead. The Surveyor project has as its purpose landing on the moon (JA 152, lines 15-16).

Of singular import was the testimony that "All of the capsules that have ever taken Americans around the world contained 8 valves of this type" (JA 144, lines 3-5), that is, the Eckel valve shown in photo Exhibit 9. "Their purpose was to permit ejections of hydrogen peroxide. . . . They constituted the astronaut's only means of orienting himself, controlling his attitude in space" (JA 144, lines 5-13).

The Mercury space capsule which carried Colonel John H. Glenn three times around the earth contained 16 of the Eckel valves in its attitude control system (JA 151, lines 2-19). The critical re-entry phase of Glenn's flight was absolutely dependent on the unfailing operation of these 16 magnetic valves weighing only $\frac{1}{4}$ to $\frac{1}{5}$ as much as magnetic valves available from Appellant's competitors.

Respecting the question of the obviousness of making certain choices of materials for the Gachon elements, Dr. Mauritz said:

"A. . . . there are three different elements in here which could be either magnetizable material

or nonmagnetizable material. So you take three elements in all of their permissible combinations and you would end up with eight permissible combinations. Now you are asking me whether it is obvious. Since Gachon has indicated there is nothing critical about it, you are asking me whether it is obvious if one can choose one of those eight and get the Eckel device. Well, I say it is not obvious. I just say it is not obvious. If a person has eight choices and you are asking him to make one of them, I say that one choice is not obvious, particularly since Gachon himself indicated that there was nothing critical about it." (JA 111, lines 6-20).

These unique successes do not add up to a run-of-the-mill improvement. If Appellant's improvement over the prior art were obvious he would not be in his present unique position.

E. The Law.

Basically there is no dispute, it is believed, as to the law. If the claimed invention is clearly taught in the prior art, an applicant is not entitled to a patent. If it was not clearly taught was it obvious to modify the prior art to produce his invention? The law set forth under Statutes at pages 7-9, *supra*, is clear. The difficulty is in the application.

It is Appellant's contention his invention is not clearly disclosed in the prior art and, in fact, not disclosed even indistinctly.

It is Appellant's contention that it was not obvious to modify Gachon to produce his very different actuator. Appellant's position is strengthened by the fact Gachon is a foreign French patent.

When, as in the present case, the prior art patent is a foreign patent with incomplete, inadequate disclosure the general rule indicated above is made even more strict. The courts, including this Court, do not approve "making out of" a foreign patent disclosure more than is to be found therein. This Court has said:

"A foreign patent is to be measured as anticipatory not by what might have been made out of it, but by what is clearly and definitely expressed in it."

(*In re Ek* (App. DC, 1927), 57 App. D.C. 203, 19 F. 2d 677)

This Court stated that view with clarity in *Davies v. Coe* (App. D.C., 1936), 83 F. 2d 602. A patent was there sought on a flexible abrasive paper, the abrasive substance being of such fineness and character as to break down hairs upon skin without scratching or impairing the skin. The Patent Office rejected upon a British patent and a United States patent. As in the instant case the foreign patent was the primary reference. This Court again made the statement:

"The disclosure of a foreign patent is to be measured not by what may be made out of it, but what is clearly and definitely expressed in it."

The Court cited the *In re Ek* case *supra* and also *Carson v. American Smelting & Refining Co.* (C.C.A. 9, 1925), 4 F. 2d 463, 5.

This rule was followed by the District Court for the District of Columbia in *General Tire and Rubber Company v. Watson* (U.S. D.C. D.C., 1960), 184 F. Supp. 344, a case involving synthetic rubber known as "oil extended rubber". The inventors had accidentally dis-

covered how to make a high quality rubber while experimenting to find a use for a tough rubber viewed as useless. Use of oil in rubber had been well known for various purposes, generally in small quantities instead of large as here. The District Court after quoting the rule relative to the interpretation to be given foreign patents as set forth in the *In re Ek* and *Davies* cases, cited *supra*, said that the British patent did not:

- (a) state that it was directed to the manufacture of tough rubber; or
- (b) show the "Mooney value and how tough the rubber in question is or should be"; or
- (c) indicate that a superior kind of rubber is derived by the use of large quantities of oil; or
- (d) indicate that the process may be used for the purpose of augmenting the quantity of the output as well as its quality.

The Court held that there was "no doubt" but that the British patent "discloses in a general way the use of oil in the manufacture of synthetic rubber, but it cannot be said to point directly to the invention involved in this case and, therefore, cannot be deemed to be an anticipation."

General Tire and Rubber Company v. Watson
(U.S. D.C. D.C., 1960), 184 F. Supp. 344,
349.

Clearly the deficiencies of the British patent in the *General Tire* case approximate the shortcomings of the French patent in the instant case.

There has been here a serious mistake of law in the weight given to the foreign French patent to Gachon.

The law of the *General Tire* case was recognized by Judge Holtzoff to be the controlling law in the District of Columbia and in *Morgan Development Laboratories, Inc. v. Watson* (U.S. D.C. D.C., 1960), 188 F. Supp. 89 at page 90, he said:

"In dealing with a foreign patent we must bear in mind the principle often laid down by the courts and recently applied by this Court in *General Tire and Rubber Co. v. Watson*, 184 F.Supp. 344, 349, that the disclosure of a foreign patent is to be measured not by what may be made out of it but by what is clearly and definitely expressed in it. The French patent to Reynaud is dated August 30, 1877, and is numbered 120,484. It will be observed that the date of the patent is prior to the invention of the phonograph, and manifestly the use of the Reynaud device in that connection could not be and was not in contemplation."

The thinking of Judge Holtzoff in the *Morgan Development* case is directly in point. In the instant case we have a solenoid weighing 1 7/8 ounces which comes to have tremendous importance in a space age in which ounces saved are of tremendous importance — a valve unit able to do the job which required earlier competitors' units weighing four or five times as much. That highly important, lightweight, efficient valve is rejected and held noninventive over a French patent issued in 1942, approximately 15 years before Sputnik ushered in the space age and the age of lightweight, highly efficient payloads; and Fuscaldo's "internal combustion engine fuel injector" was even earlier.

In neither Gachon nor Fuscaldo was the matter of weight or high efficiency with light weight a problem. Clearly the construction of the French patent was not contemplated for Appellant's use. Clearly it did not teach his invention. If it did why were Appellant's competitors making valve units weighing four or five times as much?

Appellant is aware of the burden which is his to show clear error on the part of the District Court and the Patent Office and the natural hesitancy of this Court to overrule their findings. Nevertheless, Appellant believes that clear error is present and so he brings this appeal. This Court has frequently reversed the lower court's decision when convinced that justice so required. See in this connection the following decisions:

Levin v. Coe, 76 App. D.C. 347 (1942), 132 F. 2d 589;

Poulsen v. Coe, 73 App. D.C. 324 (1941), 119 F. 2d 188;

Broderson v. Marsall, 90 App. D.C. 78 (1951), 194 F. 2d 138.

Conclusion.

Appellant's invention was not disclosed nor suggested in the French patent to Gachon 876,454.

United States patent 2,297,399 to Fuscaldo does not supplement Gachon nor disclose that it was obvious to vary the Gachon construction to enable it to perform the function of Appellant's invention.

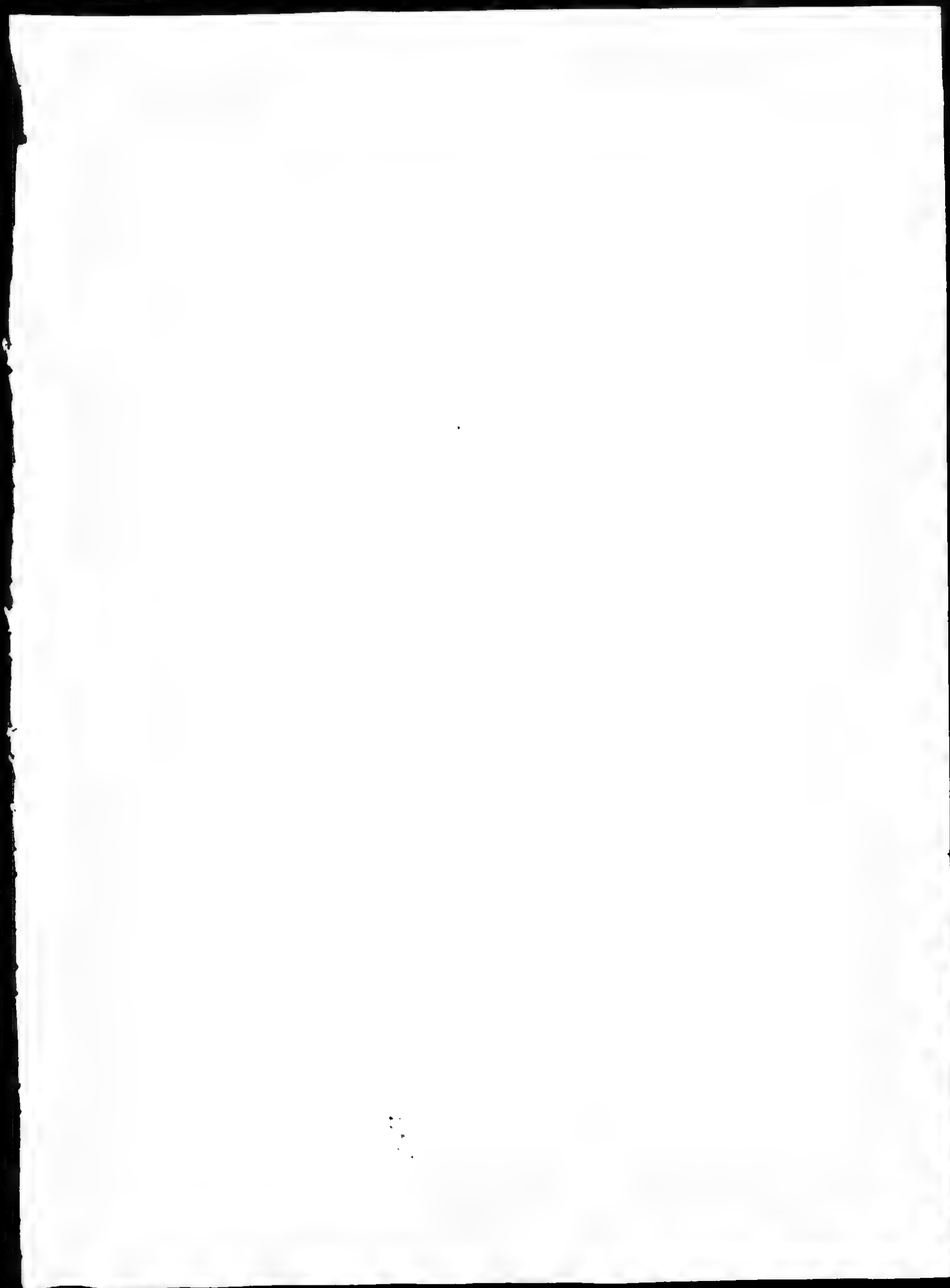
The Gachon patent is a foreign patent and the District Court in error made more out of it than is clearly disclosed therein.

The District Court erred through understandably misinterpreting Appellant's position and the evidence.

The reversal of the judgment of the District Court is respectfully requested.

Respectfully submitted,

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BRIEF FOR APPELLEE

United States Court of Appeals
FOR THE DISTRICT OF COLUMBIA CIRCUIT

Appeal No. 19,105

VINCENT W. ECKEL, APPELLANT

v.

DAVID L. LADD, COMMISSIONER OF PATENTS, APPELLEE

Appeal from the Judgment of the United States
District Court for the District of Columbia

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Of Counsel.

United States Court of Appeals
for the District of Columbia Circuit

FILED APR 2 1965

Nathan J. Paulson
CLERK

STATEMENT OF QUESTIONS PRESENTED

Appellee disagrees with appellant's Statement of Questions Presented. In the opinion of the appellee, the questions presented in this proceeding are:

1. Whether the District Court was clearly in error in holding that the Gachon French patent, No. 876,454, discloses to those skilled in the electromagnetic valve art the subject matter of the claims in appellant's patent application in suit; and

2. Whether, even if the District Court was in error as to the Gachon teaching, it committed clear error in holding that the subject matter of appellant's claims was obvious to those skilled in the art in view of the Gachon patent and the patent to Fuscaldo, No. 2,297,399.

III

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VINCENT W. ECKEL, APPELLANT

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DAVID L. LADD, COMMISSIONER OF PATENTS, APPELLEE

Appeal from the Judgment of the United States
District Court for the District of Columbia

BRIEF FOR APPELLEE

COUNTERSTATEMENT OF THE CASE

Appellant's description of the device disclosed in his application and of the Patent Office prosecution of his application, as set forth on pages 2 to 6 of the Brief for Appellant, appears accurate and would seem sufficient for this proceeding. His description on pages 6 and 7 of his brief of the proceedings in the District Court is inaccurate insofar as it suggests that the District Court did not give full consideration

to all evidence which is pertinent to the issues presented or that the District Court made more out of the French patent to Gachon, No. 876,454, (JA-260),* than it is proper to attribute to that patent disclosure.

Appellant's "Statement of Case" (Brief for Appellant, pages 2 to 7) is incomplete in failing to describe the cited prior art. A description thereof follows.

Gachon (French Patent No. 876,454, JA-260) discloses an electromagnetically operated valve 14 having a coil 16, which generates a magnetic circuit 15 in the valve casing. The casing is provided with annular portions extending into the coil. Between the ends of the inwardly extending portions there is an annular member of T-shaped cross-section. The material of which the T-shaped member is made is not stated. A movable core or armature 17 is mounted to slide within one of the annular portions and the T-shaped member and is provided with a valve seat at one end to mate with a cooperating seat on the casing. The other annular portion has attached thereto a stationary annulus 20 serving as a stop for the movable core when the coil is energized. A spring 19 is provided between the stop 20 and the core 17 to bias the core to valve-closing position.

The patent to Fuscaldo, No. 2,297,399 (JA-255), discloses an electromagnetically operated valve having an inlet 19 (Figure 1b) and a valved outlet at 43 (Figure 1a). The operator includes a coil 30 enclosed within members 1, 2, and 3 which are made of mag-

* Pages in the Joint Appendix are denoted herein by the prefix "JA-."

netizable material. Member 12 mounted between the inner portions of members 2 and 3 is of non-magnetizable material. Annular member 4 of magnetizable material extends within one end of the coil and serves as a stop member for the movable core or armature 5. The core has a closely fitting sliding engagement with end member 2 and slides within a portion of non-magnetic member 12. The hub 8 by which core 5 is attached to valve stem 9 is made of non-magnetizable material to prevent dispersion of magnetic flux in the valve parts. A spring 11 biases the valve to closed position. The magnetic circuit established upon energization of the coil is indicated at 6.

SUMMARY OF ARGUMENT

Whether or not a patent should be granted to appellant should be judged on the basis of the subject matter in his claims, giving them broad interpretation. None of the claims is limited to devices for use on spacecraft or to valves having any particular weight.

The sole issues are (1) whether Gachon discloses to those skilled in the art that his valve casing is made of magnetizable material and that his T-shaped sleeve is made of non-magnetizable material, and (2) whether, even if Gachon does not include such disclosure, it would be obvious to make the casing and sleeve of such materials.

While Gachon does not disclose whether or not his casing and sleeve are magnetizable, the record fully supports the District Court conclusion that those in

the art would be informed by Gachon that his casing is magnetizable and that his T-shaped sleeve is not.

Appellant stated to the Patent Office that Gachon's casing is undoubtedly made of magnetizable material, and his present assertions to the contrary should be accorded little or no weight.

Appellant's contention as to the material of the Gachon casing is not well taken because he offered no proof that using magnetizable material would cause a magnetic effect of any consequence at the Gachon valve faces. Appellant's claims are not so limited as to avoid the same magnetic effect complained of in Gachon.

Even if appellant is correct as to the magnetic effect at the valve in Gachon, Fuscaldo suggests moving the valve away from the coil to avoid the effect. Fuscaldo likewise suggests use of non-magnetic material for the inner sleeve.

Appellant's evidence as to the success of his device in industry is incompetent in view of his admission that patents have been granted on certain features of the valves which were successful.

The District Court made proper use of the Gachon patent since it considered only what is clearly and definitely expressed in it in determining what that patent would teach those skilled in the art.

ARGUMENT

The Matter in Issue is the Patentability of the Subject Matter of Appellant's Claims. Unclaimed Subject Matter is Irrelevant.

The issue decided by the District Court and presented to this Court for review is whether the claims of appellant's patent application, designated therein as claims 1 to 16, were properly rejected as unpatentable under Sections 102(b) and 103 of Title 35 of the United States Code (reproduced on page 8 of Brief for Appellant). Section 102(b) provides, in pertinent part, that a patent shall not issue if "the invention was patented or described in a printed publication in this or a foreign country * * * more than one year prior to the date of the application for patent in the United States * * *." Section 103 calls for rejection "if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains."

The "invention" referred to in Section 102(b) and the "subject matter sought to be patented" of Section 103 is the subject matter described by an applicant in the claims of his patent application, considering the terms of the claims apart from the application disclosure and giving them the broadest interpretation they will reasonably support. That principle was well put in *In re Carr*, 54 App. D.C. 270, 296 Fed. 1017, as follows:

"After a patent has issued, and it no longer is possible for the patentee to control the phraseology of his claims, the courts will so interpret them, if possible, as to protect him; but there is no reason, as we many times have observed, why an applicant in the Patent Office should not draw his claims to cover his actual invention only. For this reason, we have uniformly ruled that claims will be given the broadest interpretation of which they reasonably are susceptible. This rule is a reasonable one and tends not only to protect the real invention but to prevent needless litigation after the patent has issued."

See also *Ford et al. v. Marzall*, 90 U.S. App. 97, 193 F.2d 710, and *O'Brien v. Watson*, 104 U.S. App. D.C. 407, 262 F.2d 718.

Emphasis that the issue here relates to the claims is in order because of appellant's heavy reliance in his brief (pages 5, 7, 9, 11, 12, 20, 29 to 33, and 36) on the asserted efficiency, lightness, and reliability of his valve and its consequent use in spacecraft. Consideration of the sixteen claims in suit shows that only two of them are directed to valves at all, and none is limited to a structure for use on spacecraft or a structure having any particular weight.

The record is believed clearly to establish that the District Court properly held (JA-31) that appellant's claimed subject matter is (1) disclosed by the Gachon patent, when that patent is construed as it would be by one skilled in the art, and, thus, the claims are unpatentable under 35 U.S.C. 102(b) and (2) that the claims in any case are unpatentable over Gachon in view of Fuscaldo under 35 U.S.C. 103.

The Only Limitations in the Claims Not Expressly Disclosed by Gachon are the Material of the Solenoid Casing and That of the Internal Sleeve

The sole issues as to the rejected claims are (1) whether Gachon discloses to those in the art that his casing for electromagnet 14 is made of magnetic material and that his T-shaped inner sleeve is of non-magnetic material and (2) whether, even if the Gachon patent does not include that disclosure, it would be obvious to make the casing and sleeve of such materials.

Taking claim 1 as exemplary, Gachon shows (JA-260) a coil (16), an open-ended magnetizable structure (the casing around the coil), spaced pole pieces extending into opposite ends of the coil (the inward extensions of the casing and member 20), a plunger (17) slidably mounted on the structure without substantially any air gap between it and the structure, one of the pole pieces (20) serving as a stop for the plunger (17) when energized, the plunger (17) bridging the air gap when the coil is energized, and the plunger having a substantial portion disposed in the space defined by the air gap when the coil is de-energized.

That claim and all of the others are anticipated if the Gachon casing is magnetic and the T-shaped member non-magnetic. Appellant, in his discussion of the claims on pages 23 and 24 of the Brief for Appellant, speaks only of the magnetic character of the casing and pole pieces as distinguishing the claims from Gachon.

The District Court Properly Held That Gachon Discloses to Those in the Art That His Casing is Made of Magnetic Material and His T-Shaped Member is Made of Non-Magnetic Material

The District Court took note (JA-29) of the fact that Gachon does not expressly state in his patent what materials his casing and T-shaped member are made of. It found (JA-31), however, ample reason to conclude that those skilled in the art would construe the patent as disclosing the casing to be of magnetizable material and the T-shaped member of non-magnetizable material.

The dotted line 15 is described by Gachon as "a magnetic circuit" (JA-262). That line passes through the casing parts, including the inwardly extending poles and stop element 20. It avoids, however, the T-shaped member, suggestive that there is a difference in magnetic characteristics between it and the casing. The conventionality of showing magnetic circuits as passing only through magnetizable parts is demonstrated by the Fuscaldo patent in which the magnetic circuit 6 (JA-255) is shown passing through members 2, 5, 4, 3, and 1, all of which are of magnetizable material (JA-257, column 2, lines 45 to 52). At the same time the Fuscaldo magnetic circuit avoids member 12, disclosed as made of non-magnetizable material (JA-unnumbered page between 257 and 258, lines 57 to 63).

The efficiency of any magnetic device is proportional to the magnetic effect or flux developed. Appellant's witness, Dr. Mauritz, admitted on cross-examination that more flux is generated in a magnetic

material. The following appears on page 106 of the Joint Appendix:

"Q. What do you mean by 'B'? Is this a measure of some quantity?

A. Yes, it is the flux produced in the coil by— Or I should say it is the flux produced in the magnetizable material as a result of magnetism set up by a coil.

Q. So you would have more 'B' then in the magnetic material than you would in the non-magnetic material?

A. That is right."

In other words, a more efficient magnetic operator is produced if the parts surrounding the coil are made of magnetizable material.

It was equally well known (and is, in fact, only common sense) that any parts bridging the working gap (the gap in which the core moves) in an electromagnetic device should be made of non-magnetizable material to achieve maximum efficiency. As to the T-shaped member in Gachon, Dr. Mauritz testified as follows (JA-116, 117):

"Q. Now would that concentration of flux be affected by the character of the material of the T-shaped member, whether it was magnetic or non-magnetic?

A. To some extent.

Q. How would it be affected? If it were non-magnetic would the flux be more than if it were magnetic?

A. Well, let me put it this way: Assuming a constant magnet moving force between the upper end of this member 20 and the lower end of the

valve seat 6, there would be flux passing through member 20 through this working gap into the core; and also a flux passing through this T-shaped member regardless of what it was.

Q. That doesn't answer my question. My question was whether you would have more or less flux in the working gap if the T-shaped member were non-magnetic.

A. Well, I can say that from experiments—

The Court: Can't you answer that yes or no?

The Witness: Based on the experiments—

The Court: That is non-magnetic, understand, the T-shaped member—

The Witness: No, sir.

The Court: —On your question.

The Witness: On the question, assuming this to be non-magnetic, the experiments conducted would indicate or they have indicated that, with this non-magnetic, the force here would be greater; is greater."

Further, he stated that he would have assumed such to be the case without experiment in the following (JA-117, 118):

"Q. Now did you have to make experiments to find that out? Wouldn't you have assumed that to be the case without experiments?

A. Well, experiments, sir, were conducted—

Q. Why don't you answer my question and then you can make whatever explanation you want?

A. All right, sir.

The Court: Well I am no electrician but the answer to that would seem to me to be obvious.

The Witness: Maybe I missed the question. Would you read it back?

The Court: The reporter will read the question.

Reporter (Reading): 'Q. Now did you have to make experiments to find that out? Wouldn't you have assumed that to be the case without experiments?'

The Witness: I would frankly think that there would be some improvement if they were non-magnetic."

Surely, it would only be common sense that, if maximum flux is to be concentrated in a working gap, the gap should not be bridged by magnetizable material which would divert some if not most of the flux from the gap.

In summary, those in the art reading the Gachon patent would know (1) that the magnetic circuit, since it is shown as passing only through certain parts of the Gachon device, passes through those that are magnetizable, (2) that making the casing parts of magnetizable material would increase the flux in the working gap and, thus, increase the efficiency, and (3) that making the T-shaped part of non-magnetizable material would likewise make for maximum working gap flux and maximum efficiency.

Absent some circumstance definitely pointing to an opposite conclusion Gachon would instruct those in the art to use a magnetizable casing and a non-magnetizable sleeve.

Appellant's Present Assertion as to the Material of the Gachon Casing Contradicts Statements Made by Him to the Patent Office

Appellant, in what appears to be his principal objection to the decisions of the Patent Office, and the District Court, contends that Gachon would not teach making his casing of magnetizable material because if it were magnetizable, he "necessarily has working gaps at the opposite ends of his armature 17 * * *" (Brief for Appellant, page 19). Reference is made (Brief for Appellant, page 17) to the asserted "fact that if Gachon's member 5 and core 17 are magnetic, as the Court below held, energization of coil 16 necessarily magnetizes all of member 5 and all of core 17 and they are drawn together." He concludes (Brief for Appellant, page 18) that "the net force effective to displace the armature to open the valve and displace it from member 5 would be reduced" and that Gachon, therefore, "gives no indication whether it [the casing] is magnetic (magnetizable or paramagnetic) or nonmagnetic (nonmagnetizable)."

That conclusion is diametrically opposed to statements made by appellant to Patent Office tribunals. In remarks appended to an amendment of his application in suit filed in the Patent Office on November 9, 1958 (when the Patent Office examiner had jurisdiction), appellant stated as to Gachon, "The 'rigid body 2' is undoubtedly of magnetic material in view of the representation of a 'magnetic circuit 15' " (JA-180). Appellant made that same statement in his Brief on Appeal, when his case was before the Patent Office Board of Appeals (JA-195).

In short, appellant took the view in the Patent Office that Gachon taught the use of a magnetizable casing. It is submitted that his present contention to the contrary entitled to little or no weight and his assertion to the Patent Office could well be held binding upon him. In *Horton v. Zimmer*, 32 App. D.C. 217, this Court held, as to a statement made in a Patent Office proceeding:

"This admission, having been made at a hearing before a tribunal that was to pass upon the question involved in this case, bound the party making it."

In a similar situation in *Ball v. Barnhurst et al.*, 50 App. D.C. 257, 270 Fed. 693, this Court held as to a statement made in the Patent office,

"Even if we should hold that it was not conclusively binding upon him, we think it must be treated as very persuasive in determining whether or not we should reverse the Office."

Considered on Its Merits Appellant's Present Contention as to the Material of the Gachon Casing is not Supported by the Record.

Objective proof could have been offered to support appellant's assertion (Brief for Appellant, page 18) that those in the art would be led away from using a magnetic casing in Gachon. As already noted herein, the basis for appellant's contention is that the disposition of the valve parts in Gachon within the axial confines of the electromagnet would result in magnetic attraction between the valve parts in opposition to the force attracting core 17 toward member 20. Objective proof

could have been offered, but was not, to show whether any magnetic attraction between the valve parts was developed and whether it was of any consequence. Opposed to appellant's contention is Dr. Mauritz' admission that the magnetic field would be greater at the center of the coil than at the ends. His testimony on the point was as follows (JA-100):

"Q. Would there be a greater magnetic field developed here at the center of the coil (indicating), or here where the valve contacts the seat?

The Court: Assuming what?

Mr. Cochran: Assuming that the coil is energized and the casing and the parts colored red are made of iron.

The Witness: Well, because of the area here, sir, I would say the force would be greater here (indicating).

By Mr. Cochran:

Q. Where is here?

A. Here would be up at the upper end of the core member.

Q. At the center of the coil?

A. Yes."

Those in the art would assume, therefore, that the magnetic field would be greater in Gachon at the center of the device, that is, in the gap between core 17 and member 20, and that any magnetic effect developed between the valve parts would be less.

Since proof was not offered to show that those skilled in the art would know that the magnetic effect between the valve parts would be significant and would substantially affect operation of the valve, ap-

pellant's contention as to Gachon's casing lacks support in the record.

Appellant's Claims Do Not Include the Differences Between His Device and Gachon's on Which His Contentions are Based.

A principal distinction that appellant attempts to make between his device and Gachon's is that in Gachon, because the valve lies within the axial limits of the coil, the valve parts allegedly are magnetically affected, whereas in appellant's device "there is no air gap between the other (lower or outer) end of armature 19 and any other magnetizable pole or element" (Brief for Appellant, page 17). An essential characteristic of appellant's device, therefore, is that the device to be operated, such as a valve, is located outside the coil where there are no magnetic effects. None of the claims, it is submitted, is limited to any such structure. All of the claims except 9 and 11 are directed merely to an electromagnetic operator, and in none of them is the device operated said to be located outside the confines of the coil. Many of those claims require, in fact, that a substantial part of the plunger remain within the coil when deenergized.

Claims 9 and 11 are, as noted, directed to valves but they, too, fail to locate the valve parts outside the limits of the coil. Claim 9 calls for a valve seat at one end of a passage through a valve body structure which supports the coil, which is an accurate description of the placement of the Gachon valve seat. If Gachon is defective with respect to the location of the valve, the structure called for in claim 9 is like-

wise faulty. Claim 11 would seem to specify no location for the valve relative to the coil, stating merely that there is a valve seat in one of two end elements which extend within the coil.

The Subject Matter of the Rejected Claims is Obvious in View of Gachon and Fuscaldo

Even if there were substance to appellant's contentions as to the materials of the Gachon casing and sleeve, Fuscaldo would clearly teach the use in Gachon of materials of the claimed nature. As already pointed out, the Fuscaldo casing parts 1, 2, 3, and 4 are expressly disclosed as being made of magnetizable material. Further, if difficulty were experienced in using the Gachon device due to the development of a magnetic effect between the valve parts, Fuscaldo contains a clear suggestion that the valve be moved outside the coil to avoid any such effect. Fuscaldo's valve 10 (JA-255) is located at some distance from the magnetic coil at the end of a housing 27. Fuscaldo suggests, in fact, that the magnetizable armature or core 5 be connected to the valve by non-magnetizable parts to "prevent magnetic flux from dispersing in any great quantity" in the valve parts (JA-unnumbered page between 257 and 258, column 1, lines 38 to 45).

In view of Dr. Mauritz' admission, already referred to, that it would be apparent, without experiment, that the magnetic force in the Gachon working gap would be greater if the T-shaped member were non-magnetizable (JA-117, 118), reliance on Fuscaldo for that teaching would seem unnecessary. At any rate, Fus-

caldo does clearly state that the corresponding member in his device, sleeve 12, is made of non-magnetizable material (JA-unnumbered page following 257, column 1, lines 57 to 63).

Appellant's objections to the rejection on Gachon in view of Fuscaldo (Brief for Appellant, pages 24 to 26) would seem to be that Fuscaldo does not disclose the features of appellant's device that clearly are shown by Gachon, that is, the poles extending within the coil, the short internal sleeve, and the use of one end of the movable core as a valve part. Insofar as is stated by appellant, the Fuscaldo patent clearly teaches the features for which it is cited, that is, use of a magnetic casing, a non-magnetic sleeve, and location of the valve outside the coil.

Appellant's Evidence as to His Valve Filling a Need in the Aircraft and Space Industry is Incompetent.

As pointed out hereinbefore none of the claims in appellant's application is limited to devices of any particular weight or size nor is there any limitation to use on spacecraft. The evidence as to appellant's valve filling a need in the aircraft and space industry, as referred to on pages 30 to 33 of the Brief for Appellant, is pertinent only to the extent that the *claimed* features made such success possible. The testimony is ineffective for two reasons. First, appellant testified (JA-156) that patents have already been granted on the valves in question. Certain useful characteristics of appellant's valves, in addition to the features claimed here, led to patents being granted claiming those characteristics. In the ab-

sence of evidence to the contrary, the assumption is that the patented features contributed to the acceptance of appellant's valves in industry. If the filling of a need is to be considered as evidence of the unobviousness of the features claimed here, it was incumbent on appellant to produce evidence that the characteristics which led to the success of his valves are those described in the rejected claims. It was not enough for him to establish that the successful valves included the features of the claims of this application. The Court dealt with a similar situation in *Miller et al. v. Weeks et al.*, 129 F.Supp. 241, affirmed, 97 U.S. App. D.C. 138, 229 F.2d 21, as follows:

"It has been shown that the applicant has licensed its invention and it has been put to considerable commercial use. * * * The significance of this circumstance, however, becomes unimportant when we bear in mind the fact that the apparatus claims have been allowed and for all that appears the reason for the royalties may be the apparatus claims which are ready to be matured into a patent rather than the process claims which have been rejected by both tribunals of the Patent Office."

The Court of Customs and Patent Appeals made a similar holding in *In re Law*, 49 CCPA 1157, 303 F.2d 951. The Court there referred to a showing of commercial success of the appellant's dockboards and stated:

"All embodiments of appellant's invention disclosed in his application include the bead of al-

lowed claim 13. Thus, assuming the affidavits are a proper showing of commercial success, they do not show commercial success of dockboards covered by the appealed claims which are not limited to the bead of claim 13. Thus, on the face of the record, there is no showing of commercial success which we can properly attribute to the subject matter of the rejected claims."

Appellant's evidence as to filling a long-existing need would appear to be fatally deficient in another respect. In deciding whether an invention is obvious in view of cited prior art under 35 U.S.C. 103, it is of no consequence whether the applicant had actual knowledge of the art, because those working in the art are charged with constructive knowledge of the pertinent publication. However, when an applicant for patent or a patentee seeking to establish the validity of his patent relies, as evidence of unobviousness, on long-existing need and the failure of others to produce the innovation, the situation is different. In that case, if there is not *actual* general knowledge of the publication by those working on the problem in question, they have not had the benefit of it, and no presumption of unobviousness is created. The decision in *The Toledo Pressed Steel Company v. Standard Parts, Inc.*, 307 U.S. 350, pertinently states:

"As evidence in its favor on the question of invention, plaintiff cites efforts to find something useful to protect open-flame torches from extinguishment by wind or rain put forth by one engaged in operation of a street railway and by another employed by a manufacturer of lanterns.

But it does not appear that either was familiar with the relevant prior art. * * *. There is nothing that tends to raise what patentees did to the realm of invention."

Judge Learned Hand's decision in *Western States Mach. Co. v. S. S. Hepworth Co.*, 147 F.2d 345, cert. denied 325 U.S. 873, includes the following:

"It is true that, when so old a patent is brought forward as an anticipation, we scrutinize it jealously to make sure that the patent in suit has not moved a step further along, and whether the step taken may not have made the difference between success and failure; for the lapse of time may often be strong evidence that the change was not as simple as it looks * * *.

"Indeed, the very argument based upon the lapse of time loses its force, in proportion as it appears that the earlier reference is unknown." (emphasis added).

See also *Fluor Corporation, Ltd. v. Gulf Interstate Gas Co.*, 259 F.2d 405; *Lindberg Engineering Co. v. Ajax Engineering Corp.*, 199 F.2d 807; and *In re Backhouse*, 42 CCPA 800, 220 F.2d 283. In the present case, not only did appellant fail to offer evidence that the Gachon and Fuscaldo patents were widely known in the art, he expressly admitted on cross-examination that he, as one skilled in the art, never had heard of either patent until the Patent Office cited them (JA-155). Appellant has not, therefore, presented evidence which is essential if any significance is to be attached to the asserted long-

existing need, that is, that those in the art had actual knowledge of the Gachon and Fuscaldo patents.

The District Court's Use of the Gachon Patent was in Accordance With Law.

In a further attempt to disparage the Gachon disclosure, appellant cites authorities (Brief for Appellant, pages 33 to 37) for the oft-stated rule that "a foreign patent is to be measured as anticipatory not by what might have been made out of it, but by what is clearly and definitely expressed in it." (*Carson v. American Smelting and Refining Co.*, 4 F.2d 463). That rule was referred to, appellant points out, in *In re Ek*, 57 App. D.C. 203, 19 F.2d 677, *Davies v. Coe*, 65 App. D.C. 345, 83 F.2d 602, *General Tire and Rubber Company v. Watson*, 184 F.Supp. 344, and *Morgan Development Laboratories, Inc. v. Watson*, 188 F.Supp. 90. While not questioning the validity of that rule, the Court of Customs and Patent Appeals brought it into proper perspective in *In re Moreton*, 48 CCPA 875, 288 F.2d 708, in the following statement:

"Appellant attempts to disparage the value of the French patent as a reference on the ground that it is a 'foreign patent,' and is good 'for only what it clearly and definitely discloses.' That statement is true with respect to any reference, patent or otherwise, foreign or domestic. There is no basis in the statute (35 U.S.C. 102 or 35 U.S.C. 103) for discriminating either in favor of or against prior art references on the basis of nationality. We do know that some

opinions have looked askance at foreign patents but that is for the reason that the patents of some countries have been notorious for containing inadequate and incomplete disclosures. A consideration of cases will show that this type of argument has not borne fruit in this court for the past 30 years."

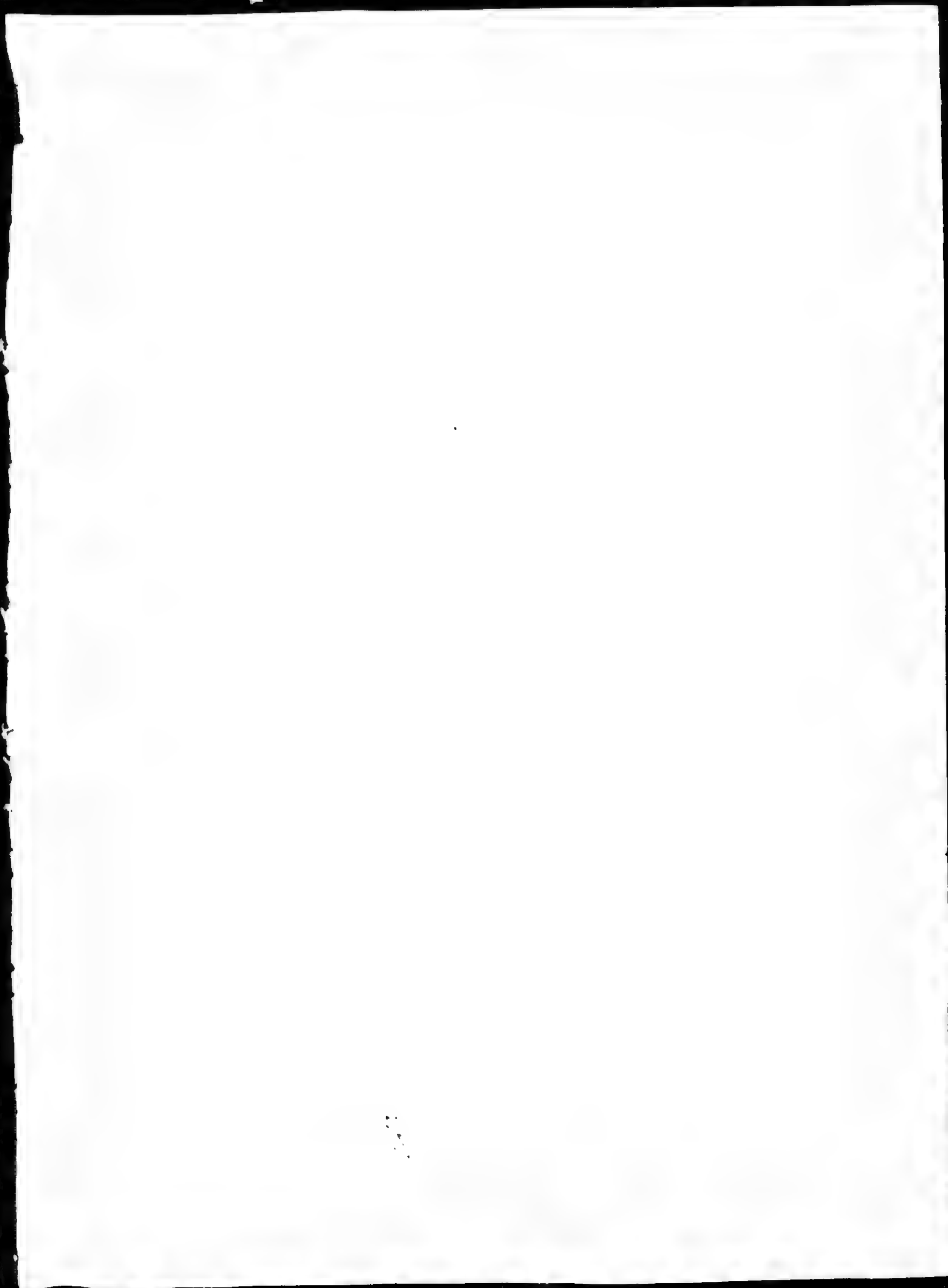
See also *In re Boling et al.*, 48 CCPA 1050, 292 F.2d 306. Gachon was relied on by the Patent Office for no more than what is clearly disclosed in it, that is, the coil, the casing (which appellant told the Patent Office was magnetizable), the inwardly extending members, and the movable core mounted on one of them to take advantage of the magnetic flux at the center of the coil where it is strongest. As already noted, any features of appellant's claims not shown by Gachon were clearly suggested by Fuscaldo.

CONCLUSION

The record, it is submitted, fully supports the District Court decision. The decision of the District Court should, therefore, be affirmed.

Respectfully submitted,

CLARENCE W. MOORE,
Solicitor, United States Patent Office.



REPLY BRIEF FOR APPELLANT.

Appeal No. 19,105

United States Court of Appeals
for the
District of Columbia Circuit

Civil Action No. 153-63

VINCENT W. ECKEL,

Appellant,

vs.

DAVID L. LADD, Commissioner of Patents,

Appellee.

Appeal From Judgment of United States District Court
for the District of Columbia.

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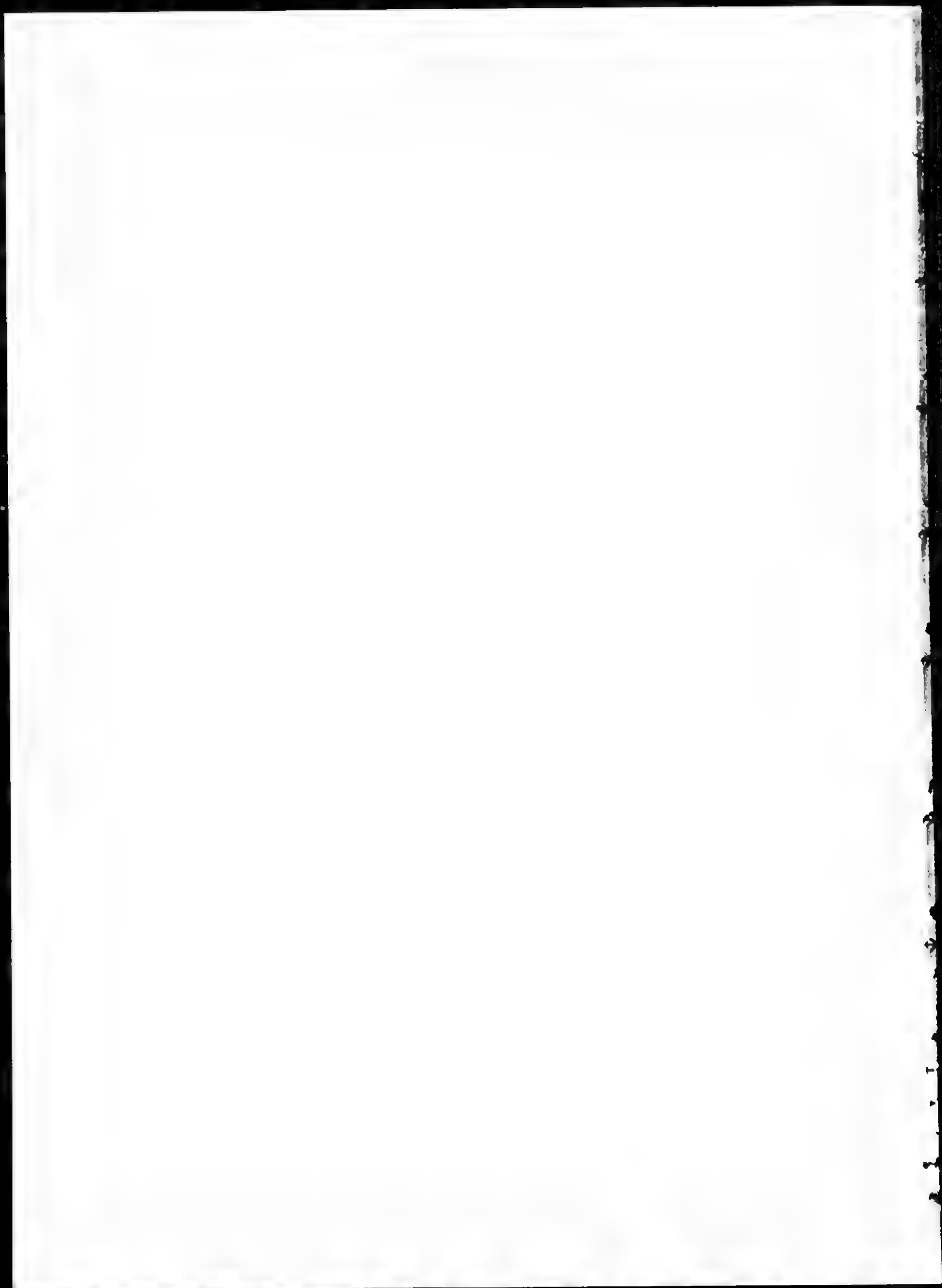
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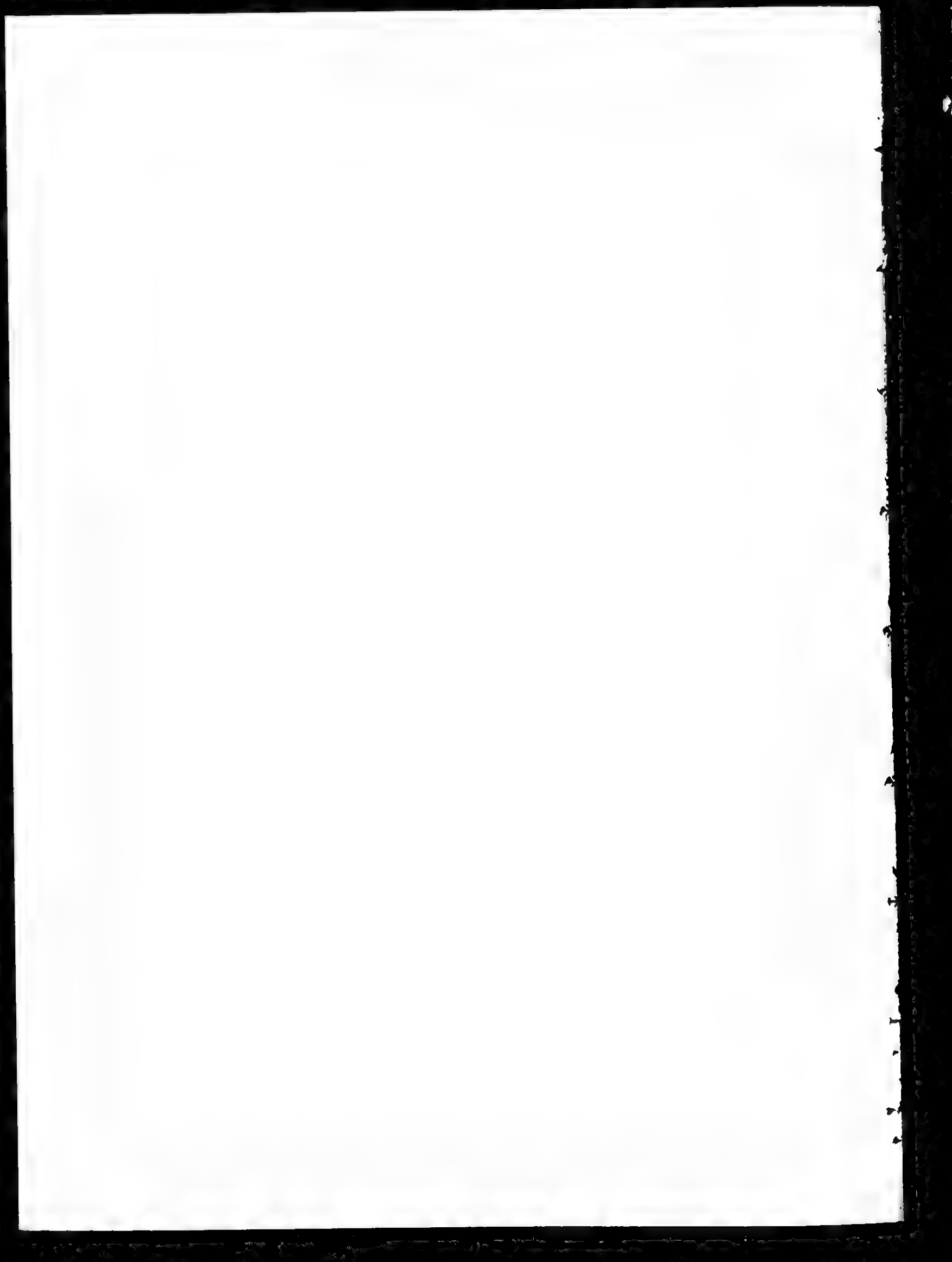
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Appeal No. 19,105

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VINCENT W. ECKEL,

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DAVID L. LADD, Commissioner of Patents,

Appellee.

Appeal From Judgment of United States District Court
for the District of Columbia.

REPLY BRIEF FOR APPELLANT.

Introduction.

Entirely avoided by Appellee's brief is the fact established by the evidence that the invention solenoid actuator, though weighing only $1/4$ to $1/5$ as much as the best competitive structures, is capable of satisfying the same performance requirements in critical spacecraft applications. This was a major accomplishment; not a minor one obvious to a person of ordinary skill in the art. Appellant's evidence establishes the use of numbers of the invention solenoid actuator in every manned capsule orbited by the United States. While this shows commercial success, the primary purpose is to demonstrate technical superiority and the advance which is present.

Appellee's brief is critical of the invention claims for lack of limitations restricting the structure to *use* with a valve or a spacecraft (Appellee's Br. p. 6, 3rd par.). There is no requirement that the claims recite the intended use — only that they point out the novel structure.

The crux of the invention is the provision of a remarkably superior solenoid actuator achieved by a unique compact arrangement of components having different specified properties. Use of the invention principles makes possible a 400 to 500 percent weight reduction and a corresponding reduction in size and in the operating power requirements. These and other important advantages result from, but need not be claimed as, elements of the unique design. Appellant is entitled, it is submitted, to protection on the crux of the invention — his improved solenoid actuator — whether used to operate a switch, a valve, or some other device, and whether used in or out of a spacecraft.

Appellee's brief seeks to excuse the failure of the basic reference Gachon to specify the nature of any of his constituent materials on the basis of being obvious to one of ordinary skill in the art, and only "common sense" (Appellee's Br. p. 11, lines 10-14). This "common sense" view of the art is contrary to the uncontradicted evidence that Gachon, if made of magnetizable material, would have two air gaps and would generate two forces acting in opposition to one another resulting in an inefficient construction. Inefficiency of itself would render Appellant's unit with its capabilities and uses an impossibility.

For ease of reference in this Reply Brief, the titles used by Appellee in its answering Brief are adopted.

ARGUMENT.

RELATIVE TO APPELLEE'S TITLE:

The Matter in Issue Is the Patentability of the Subject Matter of Appellant's Claims. Unclaimed Subject Matter Is Irrelevant (Appellee's Br. p. 5).

The essence of the Appellee's argument here is that Appellant should have recited the uses and advantages of this claimed construction.

There is no law in the patent field that the claims must describe the uses and advantages — only the structure capable of such uses and advantages. This Appellant's claims do.

The contention that the record clearly disclosed that the Gachon patent disclosed the claimed subject matter "when that patent is construed as it would be by one skilled in the art" (Appellee's Br. p. 6, last par.) flies right in the face of the fact the only expert was Appellant's expert and he testified to the contrary (see in particular Appellant's Br. pp. 18-22).

RELATIVE TO APPELLEE'S TITLE:

The Only Limitations in the Claims Not Expressly Disclosed by Gachon Are the Material of the Solenoid Casing and That of the Internal Sleeve (Appellee's Br. p. 7).

The statement that the sole issues include the issue of "(1) whether Gachon discloses to those in the art that his casing for electromagnet 14 is made of magnetic material and that his T-shaped inner

sleeve is of nonmagnetic material" (Appellee's Br. p. 7, par. 1).

ignores entirely the holding of the District Court that:

"The language of the Gachon patent did not state whether either the valve casing or the annular T-shaped sleeve shown by its drawings was made of magnetizable or non-magnetizable material. The plaintiff's claims required that the casing be of magnetizable material, and that the sleeve be of non-magnetizable material." (JA 29, 3rd par.).

Appellee contends that Appellant's Claim 1 "and all of the others are anticipated if the Gachon casing is magnetic and the T-shaped member non-magnetic." (Appellee's Br. p. 7, last par.).

The District Court admitted Gachon did not say. No matter which way one interprets the Gachon structure, he comes up with an undesirable result. If his casing is magnetic so is his T-shaped member. But whether the latter is true or not, Gachon provides a double air gap with counteracting pairs of poles and resulting inefficiency. If, however, one accepts the idea Gachon's casing is nonmagnetic, Gachon would have magnetic inefficiency, and lack of efficiency destroys the capability of Appellant's invention. Additionally the claims will not read on such a construction.

No matter which way one turns, Gachon is not the answer.

RELATIVE TO APPELLEE'S TITLE:

The District Court Properly Held That Gachon Discloses to Those in the Art That His Casing Is Made of Magnetic Material and His T-Shaped Member Is Made of Non-Magnetic Material (Appellee's Br. p. 8).

Appellee is here in error when it says that:

"The District Court Properly Held That Gachon Discloses to Those in the Art That His Casing is Made of Magnetic Material and His T-Shaped Member is Made of Non-Magnetic Material" (Appellee's Br. p. 8, title).

The Court held:

"The language of the Gachon patent did not state whether either the valve casing or the annular T-shaped sleeve shown by its drawings was made of magnetizable or non-magnetizable material" (JA 29, 3rd par.).

It then said:

"With the above interpretation of the Gachon patent, it appears to the Court that the *plaintiff's structure is completely disclosed*" (Emphasis added). (JA 31, lines 3-5).

To the foregoing was added the following:

"Manifestly, the Court cannot say that plaintiff's subject matter would have been unobvious in view of Gachon and Fuscaldo to a person skilled in the art to which all of these disclosures pertain" (JA 31, lines 5-8).

If the context of the transcript is read it is clear that the Court could not have meant that Gachon by itself

teaches a casing made of any particular material or a T-shaped member of any particular material. To so interpret the facts is to go *contra* to the Court's specific statement quoted above.

RELATIVE TO APPELLEE'S TITLE:

Appellant's Present Assertion as to the Material of the Gachon Casing Contradicts Statements Made by Him to the Patent Office (Appellee's Br. p. 12).

Counsel for the Commissioner at pages 12 and 13 of his brief contends that Appellant should not be heard to say that the Gachon casing is made of anything but magnetizable material in view of his arguments in the Patent Office.

The District Court correctly held:

"The language of the Gachon patent did not state whether either the valve casing or the annular T-shaped sleeve shown by its drawings was made of magnetizable or non-magnetizable material."

Appellant here contends that no matter what material the Gachon casing is made of it will not result in a construction capable of providing the superior novel results of Appellant's lightweight structure.

Appellant here contends that if the Gachon casing is of magnetic material he has two oppositely acting, opposing, efficiency-reducing air gaps (Appellant's Br. p. 16, last par.; p. 19, 2nd par., 3rd par.) but that if it is not of magnetizable material Gachon would not efficiently use the flux created by his coil (Appellant's Br. p. 23, 4th par.), and that if the Gachon material be "assumed to be of magnetic or magnetizable material,

he has provided an undesirable device" (Appellant's Br. p. 20, last par.).

There is nothing inconsistent with that which Appellant argued below. Appellant says now that no matter whether using magnetizable or nonmagnetizable material, the Gachon device is not satisfactory.

RELATIVE TO APPELLEE'S TITLE:

Considered on Its Merits Appellant's Present Contention as to the Material of the Gachon Casing Is Not Supported by the Record (Appellee's Br. p. 13).

Appellee's Brief, page 13, suggests objective proof should have been submitted by Appellant to support the expert testimony that opposing forces would act on Gachon's core member 17 if his casing were made of magnetic material.

It is common knowledge that when magnetic material is in a flux field one end *portion* becomes a north pole and the other end *portion* a south pole. This is true of the opposite end *portions* of Gachon's casing 5 lying within the coil ends if made of magnetizable material.

Beginning near the bottom of JA 89, Dr. Mauritz testified:

"A. Well, if this part 5 in Gachon were made of magnetizable material a person would be setting up oppositely active forces, one of which acts in the direction to defeat the purpose he is trying to accomplish. Now I will be a little more specific about that and show you just why that is. If this coil is energized here (indicating) there is magnetic flux coming down through here. And assume if it

comes down here (indicating) there will be a north pole formed up here.

The Court: It is a positive there?

The Witness: Yes, sir. We usually refer to it as a north pole. And a south pole down here (indicating).

By Mr. Kendrick:

Q. By down here, for the record, do you mean the armature would be the south pole? A. Yes, sir. The top part of the armature core, which is purple, would be a south pole. The adjacent end—

The Court: Surrounding the spring?

The Witness: Surrounding the spring and designated by the number 20 is a north pole under these conditions where the flux is coming down in this direction. And likewise, at the lower end of this purple element there is a north pole, and below that the valve seat, which is designated as 7, would be a south pole. Now we see the overall pattern. We have a north pole — south pole, a north pole and a south pole. Now we all know that a north pole attracts a south pole. So there is a force developed between the upper end of the core member and this upper member here (indicating); and also a force is developed at the other end of the core member and the valve seat 7.

By Mr. Kendrick:

Q. Now would that force develop at 7 if the material were made of nonmagnetic material?

A. No, it wouldn't.

Q. But if the material were made magnetic, the pink material in Gachon were made magnetic then there would be an attraction between the valve seat and the armature? A. That is correct.

Q. And that would be working in opposition to the matter tending to be unseated by the magnetic force at the top of the armature shown in plaintiff's exhibit 8 and the magnetic field set up by the coil?

A. That is correct" (JA 89, last 5 lines, to JA 91, line 8).

This testimony is uncontradicted and was reaffirmed during cross-examination (JA 99; JA 107, lines 1-11).

The only evidence provided was as indicated above. It was uncontradicted. No burden rested on Appellant to support it further.

RELATIVE TO APPELLEE'S TITLE:

Appellant's Claims Do Not Include the Differences Between His Device and Gachon's on Which His Contentions Are Based (Appellee's Br. p. 15).

There is some confusion here in the Appellee's contention that:

"An essential characteristic of appellant's device, therefore, is that the device to be operated, such as a valve, is located outside the coil where there are magnetic effects" (Appellee's Br. p. 15, 1st full par.).

As a matter of fact, in both Gachon and in Appellant's device it is the location of the pole faces and air gaps which is important, not the position of the valve.

The valve location is largely immaterial from the electromagnetic standpoint.

RELATIVE TO APPELLEE'S TITLE:

The Subject Matter of the Rejected Claims Is Obvious in View of Gachon and Fuscaldo (Appellee's Br. p. 16).

This subject matter is covered in Appellant's Main Brief under the following titles:

- A. Gachon's disclosure is inadequate page 14;
- B. Fuscaldo does not teach the invention
nor does he adequately supplement
Gachonpage 24;
- D. Appellant's invention was not obvious
in view of the prior artpage 30.

RELATIVE TO APPELLEE'S TITLE:

Appellant's Evidence as to His Valve Filling a Need in the Aircraft and Space Industry Is Incompetent (Appellee's Br. p. 17).

Appellee's Brief, pages 17 through 20, contends Appellant's evidence that this invention filled a long-standing need is ineffective (1) because "patents have already been granted" on the valves (Appellee's Br. p. 17, last par.), and (2) because in his testimony Appellant "expressly admitted . . . he . . . never had heard of either patent (Gachon and Fuscaldo) until the Patent Office cited them (JA 155)" (Appellee's Br. p. 20, last par.).

As respects reason (1), at JA 156, and during cross-examination, Appellant in answer to a question about the significance of the words "Patents Pending" on a "number of the valve exhibits in evidence," answered:

"A. It means when I manufactured these articles I applied for a patent and thereafter marked them patents pending.

Q. What is the significance of the plural of the word patent; did you have more than one application? A. Yes. Some have been granted on *this type of product*.

Q. You have been granted patents on this type of product? A. This is correct" (Emphasis added).

There was absolutely no evidence as to the coverage sought in the patent applications referred to or in the patent or patents granted thereon. There is no proof, only speculation. The statement was "this type of product", not the specific construction here involved. This is undisciplined speculation on the part of Appellee.

Nowhere in this record is there any evidence that Appellant has patent protection on the solenoid valve sought to be protected here. In both of the cases cited by Appellee (*Miller et al. v. Weeks et al.*, 229 F. 2d 21; *In re Law*, 303 F. 2d 951), there were allowed claims on the very subject matter for which other claims were refused for lack of patentability.

Appellant's admission that he had no prior knowledge of Gachon or Fuscaldo (Appellee's Br. p. 20, last par.) has no effect on the uncontradicted testimony that the invention met a long-standing need in the aircraft and spacecraft industry. The success achieved in meeting this need speaks for itself and is reviewed in Appellant's Brief, pages 30 to 32.

The contention made by Appellee (Appellee's Br. p. 20, last par.) that Appellant failed "to offer evidence that the Gachon and Fuscaldo patents were widely known in the art" and the admission that "as one skilled in the art, (he) never had heard of either patent until the Patent Office cited them" is most interesting.

How could Appellant establish Gachon and Fuscaldo were "widely known in the art". They are not remotely related to the field of Appellant's invention and never made an impact thereon. Gachon's patent is entitled "Gas Pressure Regulator" and the solenoid actuator is of minor importance to the extent he hardly described it. Fuscaldo's patent is entitled "Internal Combustion Engine Fuel Injector".

Prove they were widely known? They were never heard of and that is one of the reasons their use as prior art can only be theoretical and without basis from a practical standpoint.

RELATIVE TO APPELLEE'S TITLE:

The District Court's Use of the Gachon Patent Was in Accordance With Law (Appellee's Br. p. 21).

Appellee's Brief at pages 21, 22 contends, rather inconsistently, that though it is an "oft-stated rule" that

"a foreign patent is to be measured as anticipatory not by what might have been made out of it, but by what is clearly and definitely expressed in it."

yet the rule can be brought "into proper perspective" by pointing out that "this type of argument has not borne fruit in this court for the past 30 years", citing the decision of the Court of Customs and Patent Appeals in *In re Morton*, 48 CCPA 875, 288 F. 2d 708.

Appellant's Brief under the title "The Law", beginning at page 33, discussed this question and cites decisions of this Court, and of the District Court below, evidencing that well within the last 30 years this "oft-stated rule" has been both stated and followed. See, for

example, *General Tire and Rubber Company v. Watson* (U.S. D.C. D.C. 1960), 184 F. Supp. 344, and *Morgan Development Laboratories, Inc. v. Watson*, (U.S. D.C. D.C. 1960), 188 F. Supp. 89.

In this case the deficiency of the foreign patent was made crystal clear by the District Court when it said:

"The language of the Gachon patent did not state whether either the valve casing or the annular T-shaped sleeve shown by its drawings was made of magnetizable or nonmagnetizable material." (JA 29, 3rd par.).

APPELLEE DOES NOT QUESTION THE FACT THAT IN GACHON TWO AIR GAPS OPERATE IN OPPOSITION IF THE CASING IS MADE OF MAGNETIC MATERIAL AND THE T-SHAPED MEMBER OF NONMAGNETIC MATERIAL.

The opinion of the District Court (JA 29, last 3 lines — JA 30) held that Appellant introduced

"Expert testimony . . . to establish that the purpose of the Gachon device would have been frustrated had the casing been made of magnetizable material. Essential to the rationale of this testimony was the assertion that a 'second air gap' would thus be created between Gachon's movable core and the casing within which the core was mounted. This gap, it was said, would counteract the desired effect of the 'working' air gap, and would occur between the outer end of the movable core and the outer region of the annular portion of the casing, which was utilized by Gachon for a valve seat."

The Court had reference to the testimony of Dr. Mauritz concerning the unavoidable presence in Gachon of two air gaps, and two sets of opposing poles operating in opposition to one another, at the opposite ends of armature 19, if Gachon's main casing is made of magnetizable material. Appellant's discussion of Dr. Mauritz' pertinent testimony respecting these undesirable and unavoidable consequences appears in Appellant's Brief, pages 19-22.

Appellee introduced no evidence in rebuttal of this or any other pertinent testimony. It relies entirely upon the two patents to Gachon and Fuscaldo. No contention has been made on behalf of the Commissioner that Dr. Mauritz' testimony respecting the presence of the two air gaps and two sets of pole pieces operating in opposition to one another in Gachon, if his casing is made of magnetic material, is error.

Appellee's Brief does not contradict or deny Appellant's contention established by the record. It is ignored yet it is most important for, if true, it is a primary distinction between Appellant's invention and the alleged prior art patent to Gachon.

**AS A MATTER OF LAW THE DISTRICT COURT
ERRED IN DENYING APPELLANT A PATENT.**

The District Court said:

"With the above interpretation of the Gachon patent, it appears to the Court that the plaintiff's structure is completely disclosed. Manifestly, *the Court cannot say* that plaintiff's subject matter

would have been unobvious in view of Gachon and Fuscaldo to a person skilled in the art to which all of these disclosures pertain.” (Emphasis added) (JA 31, lines 3-8).

The first sentence of the above-quoted holding is manifest error. The inadequacy of the Gachon French patent to disclose completely the claimed invention is obvious from the entire record. The District Court itself said in its opinion:

“The language of the Gachon patent did not state whether either the valve casing or the annular T-shaped sleeve shown by its drawings was made of magnetizable or non-magnetizable material. The plaintiff’s claims required that the casing be of magnetizable material, and that the sleeve be of non-magnetizable material.” (JA 29, 3rd par.).

Clearly, the first sentence quoted above is error and Gachon did not teach the invention and accordingly, so far as 35 U.S.C. 102(b) is concerned (See Appellant’s Br. p. 8), Appellant is entitled to a patent.

Turning now to the second sentence of the District Court’s holding quoted above, that too is error as a matter of law.

Section 103 (35 U.S.C. 103, Appellant’s Br. p. 8) provides that:

“A patent may not be obtained though the invention is not identically disclosed or described . . . if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole *would have been obvious* at the time the invention was made . . .” (Emphasis added).

The District Court did not find that the "subject matter as a whole *would have been obvious*". Instead, the District Court held that:

"... *the Court cannot say that plaintiff's subject matter would have been unobvious . . .*" (Emphasis added).

There is no burden upon an applicant for a patent to establish that the claimed invention "would have been *unobvious*". The burden is on the Commissioner denying the patent to show affirmatively that the subject matter was *obvious*.

The Court did not so hold. It did not hold affirmatively that the claimed invention was "obvious".

As a matter of fact, the Court didn't hold that the subject matter was either "*obvious*" or "*unobvious*". The Court stated only that which it couldn't find, not that which it did find.

As a matter of law, its ruling is error. A burden was placed upon Appellant as an applicant which is not present under the law.

In the light of this clear error of law the judgment below cannot be sustained.

Conclusion.

1. For the reasons set forth in Appellant's Brief, Appellant is entitled to a patent.
2. Appellee does not in its answering Brief satisfactorily overcome the fact that the alleged prior art does not teach Appellant's invention.

3. The District Court erred as a matter of law in denying to Appellant a patent in the absence of a holding that the claimed invention was *obvious* in view of the prior art.

4. The reversal of the judgment of the District Court is respectfully urged.

Respectfully submitted,

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